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Our Surinam Contemporary.

WE have now to hand the whole of the first volume of the "West-Indië Landbouwkundig Tijdschrift," the quarterly Agricultural Journal which has been organised by the enterprise of our Dutch neighbours for the benefit of their West Indian colonies of Surinam and Curacao. We confess to a personal interest in our contemporary, for it is no secret that the existence of our own Journal was not without its effect in the conception of the Tijdschrift. We offer our congratulations to the Editor, Mr. J. J. Leys, on the successful completion of his first year's volume, and our best wishes for a long and prosperous career for his useful publication.

In his Foreword to the first number, the Director of Agriculture, Mr. D. S. Huizinga, indicates the popular character of the Tijdschrift. Items of interest of importance to agriculture will be discussed for the benefit of subscribers, and information previously issued in the form of bulletins will now find a place in pages of the Tijdschrift, leaving broad scientific questions and investigations to be issued as bulletins. Like the practical man he is, Mr. Huizinga hopes to gain the support of practical men and to see the Tijdschrift become the organ of co-operation amongst the agriculturists of Surinam.

In his Editorial Note Mr. Leys expands this theme. With the passing of the old empirical methods, he says, the need for a more scientific treatment of agriculture is pressing. The Tijdschrift will afford a medium for the exchange of views, in which a lead will be given by the personnel of the Agricultural Department. An attempt will be made to cover the whole ground—cattle and the dairy will find a place as well as the cultivation of staples and the products of the small holder. Manures and foodstuffs will be discussed together with poultry raising and questions of market. Endeavours will be made to enlist the interest of all sections of the agricultural community, and the editor appeals for practical support in the way of subscriptions, from all classes—large and small holders, managers and overseers, teachers and students. This interest can also be shown by sending information to the paper—results of experiments, figures relating to crops, and details of the results of the war against plant diseases and insect pests. A column for "Questions and Answers" will be a feature of the Tijdschrift, and another entitled "For School and Home," and queries are solicited on subjects of interest. All whom it may concern are advised to become the possessors of their own copies, so that at the end of the year the bound numbers will form the nucleus of a book of reference which will be worth consulting.

The Editor contributes a comprehensive article on "The Manuring of Rice Fields" in which he very skilfully combines practical advice with theoretical explanation suited to his readers. In substance, the article gives details closely corresponding to those already published in similar papers in our own "Journal." Mr. J. A. Liems gives some interesting details of the successful working by Javanese of certain rice land abandoned by British East Indians on Pln. Vreeland. The secret seems to have been the careful regulation of the water supply—especially the drawing off of the water. Catch-crops of maize and black-eye peas were grown before and after the rice.

The Director of Agriculture discusses fully and fairly the question whether it is better on the plantations in Surinam to devote attention to one crop only, or to have a mixed cultivation. In an appendix to the Report of the Surinam

Commission of 1910, the then Director of Agriculture, Dr. P. J. S. Cramer, advised the dividing of the risk incidental to agricultural work. Everything, he said, should not be staked on one card. Moreover, the diversity of crops had the advantage of enabling the labour force to be used more economically, as one harvest did not necessarily coincide with another, and the various cultural operations could be, with judgment, made to alternate, and the labourers thus be profitably employed all the year round. Heer Van Hasselt, the rubber expert, who came from Java to advise the Government of Surinam, did not agree with this view. At a meeting of the Surinam Agricultural Society he definitely *expressed the opinion that more than one cultivation on the* small plantations of Surinam was an economic mistake. He argued that success in these days attended up-to-date, specialised, pure cultivations on the large scale, and that the conservative estates with mixed crops were everywhere bound to go under. Mr. Huizinga considers the conflicting opinions carefully from Surinam's point of view, quotes Sir Walter Egerton and Ex-President Roosevelt and the motto: "Don't put all your eggs in one basket," and comes to the conclusion that the middle-sized plantation with sufficient area, sound financial standing and a capable manager, has an important rôle to play in tropical agriculture; and that for such it would be a mistake not to divide the risk. Nor does he believe that the small cultivator is bound to go under. That may be the case in business, but not in agriculture. The small proprietor, who feels by instinct that the one-crop system is not for him, may, and should, be the backbone of the colony.

In some timely "Hints to Small Farmers," Mr. J. A. Liems urges the necessity for careful selection of seed for sowing, and goes as far back as the Old Testament for authority. The quotation (Isaiah XXVIII., 25) in the Dutch version brings out the point much better than in our Bible: it reads, "When he has made smooth the surface of the ploughed ground, he throws thereupon the *best* wheat or *selected* barley, each in its place." The writer points out that small seeds have as a rule thicker seed-coats than large ones, require more time to imbibe water and swell, and so germinate later. Seeds of unequal sizes consequently germinate irregularly, the crop ripens unevenly, and loss is

occasioned in two ways—the over-ripe part falls before the harvest or is otherwise lost, while a good deal remains unripe when the crop is cut. Mr. Liems also contributes useful articles on "Maize" and on "Fruits," in which he sums up recent literature on these subjects, and the Editor gives a practical article on the Planting of Coconuts. In dealing with Artesian Water in British Guiana and with the amount of Nitrogen added to the soil in Surinam by Rainwater, Mr. Huizinga utilises freely the valuable results obtained by the Department of Science and Agriculture in British Guiana. With the article by Mr. A. W. Drost on "Kwak (Farinha) and its Prepartion," we deal more fully in this issue of "The Journal," as everything connected with the utilisation of local foodstuffs is of particular interest at the present time

We cannot omit a reference to an interesting note in which a claim is put forward that Jan van Geuns, an apothecary of Haarlem, (1799-1865) discovered the vulcanisation of indiarubber in 1836, four years before the Englishman, Goodyear. The details are given by W. P. Jorissen in the "Chemisch Weekblad" for September 19, 1914; and a plausible case for the Hollander is certainly made out.

A "Copper-Lime Spray" Fluid.

It is claimed that a spray fluid, cheaper, no less efficient and of greater adhesive power than ordinary Bordeaux mixture may be made from copper sulphate and alum, *plus* freshly prepared milk of lime. The formula for the preparation of this—"Martini's solution"—is copper sulphate, $1\frac{3}{4}$lb.; alum, $1\frac{3}{4}$lb.; fresh burned lime, $2\frac{1}{2}$lb.; water,, 14 gallons. The alum and copper sulphate are dissolved in part of the water. The lime is slaked and suspended in another portion of the water. The milk of lime is added with constant stirring to the solution of copper sulphate and alum until the mixture gives a distinct alkaline reaction with litmus paper. The rest of the water is then added, and the fluid is ready for use. Although it contains only half the amount of copper contained in Bordeaux mixture, it is said to be as effective a fungicide as the latter.

—"The Gardener's Chronicle": December, 1916.

Editorial Notes.

Diseases of Hevea.

SOME interesting information is given in a lecture on "Diseases of Hevea" by Mr. T. Petch, acting Director of Agriculture in Ceylon, which is reported in full in the "Tropical Agriculturist." The cosmopolitan nature of parasitic fungi is a point which Mr. Petch has emphasized on previous occasions, and it is important therefore that rubber planters in British Guiana should note the characteristics of the dangerous fungi which occur in the East and be on their guard against them. Already *Fomes semitostus*—now more correctly called *F. lignosus*—has been found in this colony by Mr. Bancroft, but as yet its occurrence seems to be rare It can be distinguished among the "bracket fungi" by the orange colour of its lower surface when fresh, but when dry it loses much of its rich colouring. A bracket fungus which is white or livid beneath is not *Fomes semitostus*, and this point may assist in diagnosis. Mr. Petch remarks that the treatment for *Fomes* is "the general treatment for root diseases *plus* hard work. Extract all dead roots, following up the laterals as far as possible; burn all diseased roots on the spot; surround the area with a trench two feet deep, throwing the earth excavated towards the centre; and fork over the patch with lime at the rate of at least one ton to the acre." *Ustulina zonata*, the cause of a root disease of tea but also attacking as wide a range of plants—including Hevea—as Fomes, is described as at first forming a white, rather soft plate which lies flat on the stem. This turns greenish, then develops a hard crust on the surface, turns purple grey and finally black. Fully developed, it is thin, flat or more generally undulating, and very brittle. Its brittle, crusty texture is a good distinguishing character. It attacks Hevea in three ways—as a root disease (the most serious form); at points on the stem where the wood has been exposed by a previous attack of canker or pink disease; and thirdly at the fork of the tree where apparently no previous lesion exists. A new root disease, caused by *Poria hypobrunnea* was discovered in Ceylon in 1904. The mycelium on the root, says Mr. Petch, takes the form of stout, red strands. These, when old, turn black; and as some sand and small stones often adhere to

the mycelium, it resembles "brown root disease" to some extent. Inside the wood of the root and the lower part of the stem the fungus forms bright red patches or sheets. It does not make a "bracket," but spreads out flat over the surface of the host, forming a plate about one eighth of an inch thick, studded with minute holes barely visible to the naked eye. The plate is white or yellowish at first, then reddish. *Diplodia* or "die-back" fungus is also referred to by the lecturer who expresses the opinion that while it might be possible to eradicate *Fomes* from an estate, it is impossible to do so with *Diplodia*. Fortunately, he says, the fungus is chiefly a saprophyte, preferring dead and decaying tissues, and is not a strong parasite. If a tree is badly attacked, it must be cut down and burned; if the diseased strip is narrow, the affected cortex may be cut out and the wood tarred. To prevent attacks by this fungus, dead branches should be pruned off and all pruning cuts tarred—advice which will be already familiar to our readers, but which we make no apology for repeating. Finally the several manifestations of *Phytophthora Faberi* are dealt with. This fungus, which requires wet weather for its propagation, is responsible for (1) Hevea fruit rot, (2) a die-back of green branches, (3) a leaf disease, (4) stem canker—characterised by the cortex turning claret colour—and (5) decay of tapped surfaces. This last effect has now been established by infection experiments by three independent workers; and the remedy given is brushing over the tapped surface—when it shows signs of decay—twice a week for three weeks with a 20% solution of "Brunolinum." The recipe for the wash is—Brunolinum, 1 gallon; water, 4 gals; soft soap, 1lb. Dissolve the soft soap in the water, add the Brunolinum and stir it up vigorously, or work it up with a syringe. It must be carried to the field in bottles which can be frequently shaken. We are not aware that *Phytophthora* has as yet shown signs of attacking the rubber trees in British Guiana, but Mr. Petch's hints are worth keeping in mind against a possible emergency. *Phytophthora* is one of the most dangerous of fungi, and its presence on cacao trees in this colony is known. *Early detection and prompt treatment* are the very essence of protection against this and the other pests mentioned, and we venture to draw the earnest attention of rubber planters to Mr. Petch's valuable lecture.

"Mildew Spots" on Canvas.

The "spotting" of canvas fabrics has attracted considerable attention since the outbreak of the war, and the cause and the cure of this trouble are discussed in a letter to "Nature" by Mr. J. Ramsbottom, the mycological expert of the British Museum, who draws attention to the work of Guéguen on this subject. The spots are caused, says Mr. Ramsbottom, by fungi which damage the fabric so that after some months it is easily torn. The fungus hyphae grow on the surface of the fabric, between, and within the lumen of, the fibres. It appears that the trouble is hardly ever due to accidental contamination, but is caused by the development, *in moist heat, of moulds already present in the newly manufactured fabric.* Practically all unbleached canvas is affected, but that bleached with chlorine compounds remains free from infection. Greenish spots, sometimes seen, are due to colonies of *Penicillium* or *Aspergillus* derived from the air, and are almost invariably non-injurious to the fabric. An investigation by Mr. Ramsbottom showed that in certain cases the fungi present in the damaged material were identical with species known to exist in the soil—many of which are active cellulose destroyers—and he is of opinion that canvas left lying about on broken ground would almost certainly be attacked by these fungi, if the conditions for growth happened to be favourable. The method of prevention recommended by Guégnen is to sterilise the tow after retting, by steam under pressure and then dry heat. Boiling solutions of salts of chromium or copper also serve, applied either to the tow or the fabric. A suitable method of rendering awnings, etc., immune is to immerse the fabric first in a 20% solution of soap, and then in 8% copper sulphate solution, each at boiling point.

The Food of Birds.

Now that the food question has become a pressing problem in Great Britain, attention is being concentrated upon the part that wild birds play in the economy of nature, and particularly upon the precise character of their food. Some interesting details are given by Mr. Walter E. Collinge in an article published in a recent issue of "Nature." The monetary loss due to the depredations of the house-sparrow is

there estimated to reach the incredible figure of £8,000,000 per annum. Double that sum may be allowed for the damage done by rooks, starlings, blackbirds and other injurious species. Including "farm vermin"—of which rats, mice and voles form the food of certain kinds of birds—the loss due to such pests may be put at something like £10,000,000 annually. To deal with the problem effectively it is not sufficient to destroy wild birds indiscriminately, as is now being done by farmers and fruit-growers in certain parts of England, but it is essential that an accurate and detailed study be made of the feeding habits of all suspected species. It is all-important to find out which birds are the culprits, the extent of the damage they do and of the loss they occasion, and the frequency with which they occur, so that the really valuable species may be singled out and effectively protected. Considerable difficulty may be caused by the fact that certain birds are useful at one period of the year and harmful at another; and it is evident that careful inquiry at the hands of thoroughly qualified investigators is necessary for the drawing of reliable conclusions. The interest taken in bird life in British Guiana has notably increased in recent years, and several names have now been added to the list of local bird specialists which is headed by that highly-qualified and enthusiastic pioneer, Mr. J. J. Quelch. We may surely hope that the time is not far distant when accurate detailed accounts of the food and feeding habits of our most important birds will be available for the guidance of those engaged in the practical work of agriculture.

A Hint for Rubber Tapping.

Facts are now emerging from the hitherto conflicting results of tapping experiments, and there are many records which show that little is gained by multiplying the number of cuts, that the renewal after daily tapping is poor, and that though daily tapping gives more rubber than alternate day tapping it is not economical. It is always unsafe to prophesy, yet we would hazard the opinion that, with rubber at a low price, estates will find it more profitable to adopt a system based on one cut, and alternate day or three-day tapping.

—"The Tropical Agriculturist": November, 1916.

"Cowfly Tigers."

An Account of the Hymenopterous Family *Bembecidae* in British Guiana.

By G. E. Bodkin, B.A., Dip. Agric. (Cantab.), F.Z.S., F.E.S.,
Government Economic Biologist.

All observant people in British Guiana are familiar with the family of wasps known scientifically as the *Bembecidae*: the Creole, with his wonderfully descriptive vocabulary, calls them "cowfly tigers" and it would be hard to find a term more illustrative of the habits and colouration of such insects.

These wasps are solitary; that is to say the nests are constructed apart from one another, one female constructing, provisioning, and supplying a single egg to each individual nest. These nests are however very frequently met with in colonies often consisting of several species of wasps.

Such colonies, especially the larger ones, are wonderfully fascinating to watch. On a bright sunshiny day, when the sun is at its hottest, these black and yellow wasps are extremely active, darting about in the vicinity of their nests, the vibration of their wings producing a continuous low hum which is audible at some distance. From time to time a female alights at the entrance of her nest—which, by the way, is not purposely concealed during the absence of the owner as with some species—and after some moments of investigation, as though she were fearful of being seen to enter, she makes a sudden dive into the tunnel and disappears for a time.

Every now and then two females may be observed engaged in a fierce conflict over some prey, both insects falling to the ground locked in a pugnacious embrace.

The males, who bear no part in the construction of the nest, hover aimlessly around; it is doubtful whether they ever catch living prey as do the females; their business in life is chiefly concerned in feeding on the nectar of flowers and in the propagation of their kind.

CONSTRUCTING THE NEST.

The vigorous fossorial operations of the females, during the earlier periods in the construction of the nest are of interest. Considerable time is spent in choosing a favourable spot; and after several trial diggings, as soon as the female is satisfied, she at once commences to dig with incredible vigour, a continuous shower of dust and minute pebbles flying out behind as she works with her fore legs From time to time she ceases digging and actively clears away from the vicinity of the nest all the debris which she has displaced. Soon she has "dug herself in," and the burrow is continued to a depth of about 6 inches. These burrows are seldom straight and appear to follow the " line of least resistance " in the soil encountered. As soon as the burrow is completed the female sallies forth and procures a fly—either a " cowfly " (*Tabanidae*) or occasionally flies belonging to the families *Syrphidae* or *Stratiomyidae*—and, having stung it and thus causing total paralysis without affecting the life centres, carries it clasped beneath her abdomen by means of her legs, to the nest which she promptly enters. Having deposited it carefully at the end of the tunnel she places an egg thereon.

This egg eventually hatches into a tiny white grub which at once commences to feed on the food provided by its mother. A regular supply of such food is brought in and the grub grows rapidly; eventually it spins a tough cocoon in which it passes its pupal stage and emerges at last as the adult wasp which is so well known.

Soil of a light texture, preferably a real sandy soil, is selected if possible, by these insects for their nests. At times nests may be found in soil of a really stiff consistency. The reef of sandy soil which runs roughly parallel to the sea coast some miles inland, almost along the total front lands of British Guiana, abounds in colonies of the *Bembecidae*. Away in the far interior wherever sandy soil occurs there will be found some member of this family constructing or provisioning her nest. A short account will be given later on in this article of the various species which occur in the colony

INTELLIGENCE.

Riding aback of most sugar estates, as soon as the sandy reef is reached, the mule which one rides is quickly surrounded by "cowfly tigers" darting quickly about and making a most penetrating search for the presence of cowflies on the quadruped. Long experience has taught them that the advent of a warm blooded animal, be it man or beast, signifies that sooner or later their natural prey, the cowfly, will make its appearance.

Much in the same way does the Old Witch (*Crotophaga ani*) follow cattle or sheep in the pastures, knowing that the passing of such animals through the grass disturbs sundry grasshopers and other insects on which these birds live. Parallel instances commonly occur even among the highest forms of life.

A cow when tethered in the pasture is perpetually being investigated by these wasps for cowflies. I well remember a particular instance which I once observed. A large—in fact, the largest—species of cowfly which exists in British Guiana alighted beneath the abdomen of a tethered cow and started to feed in the slow and systematic manner which these flies adopt. Very shortly after the arrival of the fly a Bembecid wasp turned up and apparently at once observed the fly. I was somewhat surprised that it did not immediately seize the fly, and there seemed to be some reason for it. Meanwhile the abdomen of the fly was rapidly increasing in size, due to the ingested blood, and just as it had obviously become replete the wasp quite deliberately, in one fell swoop, seized the unhappy insect and bore it away. This incident would indicate that the Bembecidae prefer cowflies when fully engorged with blood and are prepared to wait till such has taken place. Certainly when investigating the nest contents of these wasps the contained cowflies are frequently to be found gorged with blood.

The females have extraordinary powers of finding their nests always alighting with the greatest precision at the mouths of their burrows. This may be readily demonstrated by covering with loose earth the mouth of the burrow and smoothing all down so as to make the spot coincide in appearance exactly with the adjacent soil. On her return to

this nest the female never hesitates but proceeds to the exact spot and with a few deft excavations rapidly discloses the entrance.

The following is an account of the various species which occur in British Guiana with observations on the biology of one species which I have had the opportunity of investigating both in the field and in the laboratory. I am indebted to Mr L. D. Cleare, Jnr., who, during my inevitable absence, recorded some points in the life history of one species as it occurred in the laboratory.

Bembidula discisa, Tasch and *Bembidula variegata*, Ol.—I am indebted to Mr. M. A. deFreitas of the B. G. Museum for both these species. They are apparently rarely met with. Both the specimens were collected on the Upper Demerara River.

Monedula pantherina, Handlsch.—This is a fairly common species in the interior districts. It is the largest species of the family as it occurs in British Guiana. Nature of prey uncertain.

Monedula punctata, Lep.—An uncommon species to be met with in the interior districts.

Monedula signata, Latr.—The commonest species in the colony. To be met with in all sandy and medium soils. Prey exclusively flies.

Monedula surinamensis, Dahlb.—Another common and widely distributed species. Prey the same as *M. signata*.

Monedula denticornis, Handl.—A fairly common species An almost complete account of the biology of this species will be found later in this article.

Microbember sulfura, Spin.—I have observed this diminutive species to be common on the white sand at the Penal Settlement, Massaruni. It is very inconspicuous and possesses a very swift, darting erratic flight rendering its capture, especially on the glaring white sand, extraordinarily difficult. Its nesting habits were unobserved.

Bicyrtes discisa, Tasch.—An uncommon species. Taken on one occasion only at Parika, West Coast.

MONEDULA DENTICORNIS.

The following is an account of the biology of *Monedula denticornis*, Handl.

A large colony consisting of wasps belonging to this species and *Monedula signata*, L. was observed on a broad foot path quite near to the public road just below the Leper Asylum. Large numbers of cattle frequently pass over this path as well as many people. These numerous comings and goings did not appear to incommode the wasps in the slightest. As previously stated the females have no difficulty in re-locating their nests despite the fact that all signs of their presence may have been obliterated by the hoofs of passing cattle. Quite possibly these passing cattle provide a certain number of cowflies for the wasps.

The soil here was of a fairly stiff consistency and the first inch was distinctly hard owing to the continual passage of many feet. A number of the burrows were carefully dug up and their contents examined. The burrows themselves penetrated about 6 inches into the soil but were straight; they appeared to follow closely the line of least resistance in the soil in a slanting downwards direction. In many cases 3 or 4 old and empty cocoons were found imbedded in the soil at the end of the burrows as well as a living cocoon or in some instances a larva. Never more than one larva or living cocoon was found in one burrow. This would indicate that the burrows are used several times over.

Larva in many various stages of development were found, in all cases they were well supplied with flies. In one burrow the remains of four distinct species of flies were observed as follow:

Stomoxys calcitrans, L. (*Muscidae.*)
Hermetia illucens, L. (*Stratiomyidae.*)
Eristalis obsoletus, Wied. (*Syrphidae.*)
Tabanus trilineatus, Latr. (*Tabanidae.*)

Several partly grown larvae were brought back to the boratory and placed in glass tubes partly filled with damp

sand, plugged with cotton wool and kept, of course, in the dark. These were regularly supplied every morning with fresh *Tabanidae* captured in the Botanic Gardens. The flies were partly crushed before presenting them to the wasp larva. Feeding commenced at once and this method of artificial breeding proved perfectly successful.

HOW THE LARVA FEEDS.

The manner in which the larva feeds was observed as follows: The first few segments immediately behind the head are considerably smaller and more elongated than the other body segments. When feeding these segments are stretched out and by means of the long, sharp and powerful mandibles the hard chitinous covering of the prey is soon penetrated. No particular spot in the body of the prey is selected for attack, but if unable to pierce the chitin at one spot the larva soon commences at another. The whole of the contents of the body of the fly are cleaned out by the Bembecid larva, likewise the thorax, only these empty shells, the legs, wings, and head are left. At times the larva may be seen with its head and first two segments buried within the body of its prey.

This larva has the typical Hymenopterous appearance, being cream yellow in colour and, with the exception of the head and its appendages, extremely soft and vulnerable. Its length, when normally extended and fully grown, is just under one inch.

The quantity of food consumed must be large when the size of the larva is taken into consideration. One larva which was kept under observation during one night consumed 3 *Stomoxys calcitrans* and one *Tabanus trilineatus*, and during the following day consumed another 3 *Stomoxys* and one large specimen of *Tabanus semisordidus*.

PUPATION.

Pupation and the formation of the cocoon take place as follows: As soon as the larva is fully fed it ceases to feed and becomes restless, moving its head and first few segments unceasingly from side to side as though commencing to spin. After some hours spinning actually does commence and

soon the rough outline of the future cocoon is discernable. The larva works first at one end of the cocoon and then, turning, works at the other end. In a day and a night of ceaseless spinning the cocoon is completed. In shape the cocoon is oval with one end drawn out to a sharp point; the blunter end contains the posterior part of the pupa. In colour it is a dirty brown and of a somewhat brittle consistency; the measurements are—length, 1 inch; greatest breadth, $\frac{1}{4}$ inch.

Around the middle of the cocoon, on the exterior surface, are four small, rough spots which stand out slightly from the surface. They are equidistant from one another and are a regular feature of all such cocoons.

The position assumed by the larva in the cocoon when ready to pupate is curious—the head and first few segments are bent downwards on the body and the whole larva shrinks slightly, becoming somewhat shorter and stouter.

Under artificial breeding conditions the pupal period was 60 days.

The adult wasp emerges by biting through the cocoon at a short distance from its apex, thus making a kind of lid. About one day is necessary before the wasp becomes properly hardened and ready for flight.

Since writing the above I have observed a further curious habit of the wasps belonging to this family. Towards evening, in close proximity to the seashore on the Courantyne Coast, I observed at least a hundred of these insects clustered together in a mass on a species of low growing maritime plant, common in that locality. On being disturbed, they dispersed, but soon clustered together again on another plant The species appeared to be *Monedula surinamensis*, Dahlb; unfortunately, I was unable to determine the sex. Some half dozen clusters of varying sizes, of these wasps were thus observed.

A New Bean for the Year, 1917.

Dolichos Lablab, var. *macrocarpa*, Waby.

By J. F. Waby.

The Colony of British Guiana has the honour of having produced a new bean of the "Hyacinth bean" class, locally known as "Bonaviste" bean.

This section of the Bean family has furnished a long list of varieties which are used for the table, but on account of the small size of the pods, most of them are used as shelled beans; being allowed to produce their seeds to the full size and before becoming hard are shelled, cooked, and served in the same manner as are "green peas," either as a side dish, or made into soup. A very few, however, have pods sufficiently large and palatable to be used as "Snap beans" in the same manner as "French beans," locally known as "Sinabones," or as the well known "Scarlet Runner" of English Gardens; *i.e.*, the whole of the young pod being cut up and served as a green vegetable. "French beans" are always in demand but are rarely available.

Notably in this section are the "Park Runner" and "Vilmorin's Stringless," both of which have been written about on several occasions and need no further mention, except to emphasize the fact of their excellence, especially that of the "Vilmorin" bean.

A NEW HYBRID.

This year I have added another to the list—a natural hybrid of these two, which undoubtedly will prove a welcome addition to our green vegetables, and should, as it becomes known, find a place in every garden in the Colony. It bears the largest pod of any of the "Lablab" class which has yet appeared, and on that account fewer pods will be needed to form a dish. It is prolific; the pods are longer than those of either of its parents, and have the width of those of the "Vilmorin" bean, which till now is the widest known.

HOW THE HYBRID AROSE.

The discovery came about in this wise. I have grown the two beans mentioned in close proximity for many months; no one but myself has touched these plants for any purpose whatever. The seeds saved were of my own picking so I can vouch for the accuracy of the seeds sown. I sowed 3 dozen seeds of the white flowered "Vilmorin" bean, most of which grew. Judge of my surprise when one morning I saw the first produced inflorescence was of a pink colour where I expected white flowers, and in a long raceme instead of a close cluster. Two or three days later two more inflorescences appeared with pink flowers, as well as a few white ones on some of the other vines. On close examination I found the vine bearing the pink flowers was of a darker colour to the others and was easily traced to the root. There was but one plant of this description in the batch of seedlings.

The first flowers produced but two pods, and when these were closely examined it was evident that the "Park Runner" had "crossed" with the "Vilmorin" bean, and this plant with the pink flowers was a hybrid. The beans partake of the nature of both parents; the texture is that of the "Park Runner" and the form that of the "Vilmorin" bean, but larger than either. The "Runner" has a roughish edge at the ventral suture, the new bean is rough on both sutures similar to the "Vilmorin" but more emphasized. The point is not so much recurved as in the "Vilmorin," but is less straight than in the "Runner." The colour is between that of both, of a paler green than the "Runner," with a decided *soupçon* of the colour of the "Vilmorin," giving the pod a grey tinge. It seems likely to be very prolific.

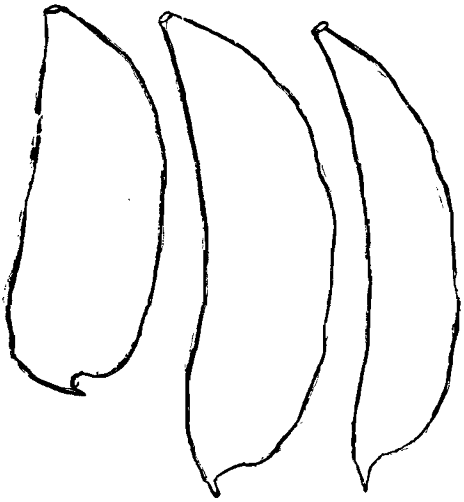
The 2nd and 3rd inflorescences gave 6 and 7 beans respectively; these were picked when sufficiently grown and used to test the flavour. This proved highly satisfactory, with the good qualities of the "Park Runner," though lacking the extreme delicacy of the "Vilmorin bean."

My two first pods gave 10 seeds; these were sown but alas! although all grew, my neighbours' fowls killed 9 of them. The solitary plant, however, grew well and is fruiting. From the original plant several dishes of beans have been culled and there are plenty more.

CHARACTER OF THE NEW BEAN.

The new bean is a much stronger grower than either o its parents so will need more room. The seeds should b planted 5 to 6 feet apart The stakes or trellis for it to clim on should not be more than 5 to 6 feet high for the convenienc of picking for a green vegetable. Use in the same manne as "French beans" before the seeds are well formed; i allowed to mature as Bonavists generally are, the seeds ca be shelled in the same manner, though I consider the youn green pods are the most useful, as good green vegetables ar scarce.

The following are sketches—half-size—of the parent an hybrid beans:—



Vilmorin. Hybrid. Park Runner.

The flowers of the "Vilmorin bean" are pure white in clos clusters; the seeds are dark brown.

The flowers of the "Park Runner" are purplish in lon racemes; the seeds black or brown and speckled.

The flowers of the "hybrid" are of a pale purplish pink in long racemes; the seeds similar to those of the "Parl Runner."

We rave over imported "Lima beans," the "Stringless" and "Wax beans"—and rightly too because they are delicious—but they are always luxuries which everyone cannot afford to grow, as they cost extra for constant importation and need much attention; we are disappointed when we find the creole seeds of these are not satisfactory; we forget that they are products of a temperate climate, and like Tomatoes deteriorate so quickly that they must be renewed practically each time of sowing. Unlike these, the beans of which I write, and have written frequently, are products of the tropics, all are of simple culture, and the creole seeds come true to type. Some of them are excellent and all are very palatable, but *they cannot be said to be luxuries; they are* essential for a general supply of vegetable food and *should*, and *can be grown* by everyone with little labour and expense; and as the better kinds can be grown as easily and cheaply as the inferior ones we may as well have the best.

Methods of Arresting Drift Sand.

Works on a considerable scale have been carried out on the coasts of Cape Colony, for planting and protecting drift sand. One method adopted was to cut down brushwood, which was then simply laid on the sand surface, seeds of suitable sand plants being sown amongst the brushwood. Another method used was to fix brushwood hedges, about 15 or 18 feet apart; to protect the sand surface from the wind, these protected areas being sown as before. The medicinal aloe was found useful in this work; when a branch is cut off and stuck in the sand it soon takes root, protecting hedges being formed in this way. Drifting sand in Cape Colony has been also arrested by putting up rows of poling boards, with spaces of about 4 inches between the boards; these fences, which have the same function as a groyne, project about 18 ins. or 2 ft. above the sand, which, in addition to being banked up on the windward side, passes over the boards and through the openings to the lee side, where it is also deposited. As the sand collects the boards are drawn up, and, when a sand-hill of required size and dimensions has been formed, the seeds of various sand loving grasses and trees are sown, Kaffir, fig and maritime pines being found useful.

—"Coast Erosion and Foreshore Protection," by S. Owens, and O. Case

Lessons with Plants in British Guiana.

By the Editor.

"*It is finding answers to questions which chiefly deserves to be called Science.*"—L. C. Miall, F.R.S., in "Teaching and Organisation."

X.

FRUITS.

You will have noticed long before this Lesson that most flowers in their natural habitat soon wilt, fade, and are replaced by fruit. Beyond noting that *pollination* is, in almost every case, a necessary preliminary to the setting of fruit, we can postpone the consideration of the details of fertilisation until a future occasion, and confine ourselves to the ripe product.

Reverting to the first flower we examined, the Hibiscus, how often do you find fruit on the bush? Is this due to lack of pollination? Do you find "pollen-dust" on the stigmas? The pollen grains in this plant are usually yellow and are conspicuous enough not to be overlooked. Compare what you find in the Hibiscus with the state of things in the Ochro. Study the growth of the fruit in this plant from the earliest stages to complete ripeness—*i.e.*, till the fruit splits to liberate the hard, brown seeds. How much does the fruit split, and how far are the seeds liberated by the splitting? And if the seeds fall out, what happens to them? Place a few seeds on a smooth table and note their shape and the character of their surface; then blow them gently and note the result Get some seeds of the common Canna or "Indian Shot." Repeat your observations and the experiment, and compare results.

THE PARTS OF A FRUIT.

One or two points will become clear from your study of the development of the fruit. The *ovules* which we found in the ovary evidently become the seeds, and the wall of the ovary develops into the dry, brown, outer covering or *peri-*

carp. The seed has its own covering or *testa*; perhaps two —when the inner coat is termed the *tegmen*—and the seeds are further protected by the fruit wall. Where there are two or more seeds, it is an easy matter to distinguish between a fruit and a true seed, but if the original ovary has only one ovule, or if only one ovule develops into a seed, the matter is not quite so simple. Examine a grain of maize, and extend your observations to progressively younger specimens. You will find it impossible in the ripe fruit to separate the testa from the pericarp, and as a matter of fact the whole structure is not uncommonly referred to as a "seed." Botanically speaking, the correct term is "fruit," *i.e.*, a ripened *ovary*: and this type of fruit, which is characteristic of the Grasses—the Natural Order *Gramineae*—has received the name of *caryopsis*. You will note that it never splits or *dehisces*, and that each ovary had originally only one ovule in it. Similarly examine the fruits of the sunflower or other "compositous" flower. Here again the ovary has one ovule only, but the position of the *gynaecium* in relation to the rest of the flower is different. In the *Gramineae* the ovary is superior—i.e., the other whorls of the flower are inserted *below* it—in the *Compositae* it is *inferior*, *i.e.*, the other whorls of the flower are inserted *above* the ovary. Compare carefully the structure of these two fruits, making sections and drawing what you see. Can you separate the seed from the pericarp in the sunflower fruits? Note the common "Soldier's Tassel" of the dams when fruiting, and compare it with the sunflower. What makes the "tassel" part, and what use does it serve?

METHODS OF DEHISCENCE.

It will be interesting to examine a number of dry fruits to ascertain the different ways in which the splitting can be accomplished. Compare the fruits of the Ochro (*Hibiscus esculentus*) with those of the round-leaved Hibiscus (*H. tiliaceus*) growing at Kitty corner. The flowers are very much alike, but the fruits differ considerably. A compound fruit, such as that of the *Malvaceae* may split in several ways. You will recall that the ovary of the flowers of this Natural Order is frequently *syncarpous*, *i.e.*, made up of several carpels united together by their ventral sutures, and with the placentation axile. The ripe fruit may dehisce in such a

way that the carpels are separated as complete units, and the seeds are not exposed; or the split may occur along the original division between the carpels and the *valves* so formed may bend back carrying the seeds with them *on their edges*; or the carpels may rupture along the line of the dorsal suture, *i.e.*, between the septa, when the seeds will be found along the centre line of the valve; or the valves may bend back, leaving the seeds still attached to the central placenta; or these methods may be combined in the one fruit. The first way mentioned results in a fruit called a *schizocarp*, the second method is called *septicidal* dehiscence, the third *loculicidal*, and the fourth *septifragal*. Apply these terms to as many fruits as you can—to the Castor Oil, to the Nanny-foot Convolvulus, which is growing so abundantly now along the coast above Kitty, to the various species of Hibiscus, to the Sand-box, and as to many others you come across.

"SPURIOUS" PARTITIONS.

Simple fruits, if dry, may also dehisce. Study the various forms of legume or "pod" of which this colony supplies so many examples. Examine ripe fruits of the Barbados Pride, Bauhinia, Tamarind, Cassia, Flamboyant, the tree which goes, in this colony, by the unfortunate name of "Stinking Toe," and of some "Bread and Cheese" tree. They are all "legumes" or "pods" in the broad sense of that term, but they differ in many respects from each other. A careful study of these differences will be instructive. You will find that an ovary which was originally formed of a single carpel and had no divisions—was "one-celled" as the old term had it—may become divided up by the growth of fleshy or woody partitions, as it develops into a fruit, and that internally the fruit may be filled with a more or less juicy pulp. You will note, too, that some of these fruits do not dehisce or split at all, and that the term "legume" is a very elastic one. The development of *spurious* partitions in a growing fruit is not at all an uncommon phenomenon—examine the ovary of the *Datura* or Thorn-apple, which is common in waste places in the colony, and compare it with the ripe, prickly fruit in transverse section. The "sweethearts" (the flat kind) which adhere to the legs of your trousers as you walk through the grass on the dams are another interesting

example. In this case the divisions mark the points of rupture of the fruit which breaks up into a number of "articles" each rather like a purse in shape. On the other hand, it is not unusual for a syncarpous ovary to develop into a fruit with but one seed in it—this seed growing at the expense of the others. Examine cross-sections of ovary of the Mangrove, (*Rhizophora*) and of the the Coconut flower, and compare them with the ripe fruit.

SUCCULENT FRUITS.

The tendency of the fruit to become filled with a succulent pulp, which we noted in the Tamarind, is much more pronounced in certain other and very familiar fruits—their succulence being indeed the reason of their familiarity, as in the case of the Mango. Your experience will tell you that the Mango has an outer skin or rind, a thick layer of juicy pulp inside that, and in the centre a stone or "pit" which encloses a seed. It is a type of the "stone fruit" or *drupe*, in which the pericarp—which you will remember is the developed ovary wall—is differentiated into three layers, an outer or *epicarp*, a middle or *mesocarp* (the succulent layer) and an internal, hard layer, the *endocarp*. Now re-examine the Tamarind fruit, and try and make out these layers therein. It will be good practice. Do the same with the Avocado Pear. We are already familiar with the immense variety in Nature and with the impossibility of squeezing everything into a definition. So do not be surprised if you find many fruits which do not correspond precisely to any definition. The older botanists who delighted in multiplying names, invented a bewildering number of terms for the many varieties of fruits, but it is not worth our while to memorise all these. It will be sufficient if we are able to dissect a fruit and describe it accurately, and trace its development intelligently, noting particularly whether it is derived from a superior or from an inferior ovary. Thus we may examine the Orange and the Guava, and compare both with the Squash or Cucumber and the Grape. All are many-seeded, and more or less pulpy with the seeds lying in the pulp, and all may be considered varieties of the *Berry*, in which the pulp is formed from the placentas, *i.e.*, the parts of the ovary which bear the ovules But if you like you can give a separate name to each. The

only true berry of them all is the Guava, which is the product of an *inferior* ovary and has the hard seeds *lying free* in the pulp. The Orange is derived from a *superior* ovary and has a few seeds which are by no means hard in texture. It may be called a *hesperidium*—oranges were the "golden apples" of the fabled Garden of the Hesperides. The Cucumber is a *pepo,* as the pulp is not very pulpy and the seeds are not free, while the Grape goes by the name of *nuculanium* as it is produced from a superior ovary. Further, we have the Calabash, which is also a kind of berry, but is called an *amphiscara* as it has a thick, woody outer rind. You see where one gets to when the passion for names is allowed a loose rein.

Perhaps the most comprehensive and useful name of all is the *capsule,* which denotes a superior, one or many-celled, many-seeded, dry, dehiscent fruit. It is remarkable how many fruits come within that definition. A capsule may dehisce by valves, or by pores, or transversely, or partially—study the fruits of the Mahogany, the Crab-tree, the common little Wild Ipecacuanha of the dams, and many others.

AGGREGATED FRUITS.

Sometimes a number of flowers will unite into a mass as they form fruit, and then we get a spurious fruit which is the product of an inflorescence and not of a single flower. The whole mass may become succulent, or it may turn woody. The Pineapple is an excellent example, and the Mulberry, which is remarkable in that the succulent part of the fruit is composed chiefly of the *calyces* of the flowers. Examine now the curious "cone" of the Casuarina tree which is so commonly planted in gardens, and try to make out its structure. Also try a Fig. In this case the bulk of the fruit is formed by the swollen and fleshy receptacle, and what appear to be seeds are really separate fruits formed from the minute flowers which line the interior of the cavity. Something similar is seen in apple and pear fruits, in which the bulk of the eatable portion is probably receptacular in nature. A separate name—the *pome*—has been given to the fruits of the Apple, Pear, Quince and Medlar, which form a well-defined group of the N.O. *Rosaceae.* Now, recalling what we said above concerning the fruit as the product of an *inflorescence,* examine the Soursop and its relatives; are these fruits formed from a single flower?

DISTRIBUTION OF FRUITS AND SEEDS.

The "struggle for existence" is a well-established fact in Nature; the more alike organisms are, the more similar are their demands for food, air and light, and the keener is the fight to survive among them. It is, therefore, obviously an advantage to a plant to have its progeny develop as far away from the parent as possible: and as an ordinary green plant is fixed once it has sent its root into the soil, it is clear that the only time it can travel is when it is very young. The various ways in which fruits and seeds are distributed —the "centrifugal tendency" in plants—is a most interesting and profitable study.

We have already mentioned one fruit which is carried on the clothing of human beings or the skin of animals—the small, flat sweethearts, which are portions of the pods of a species of *Desmodium*, but there is another kind, the fruit of the "burr-grass"—*Cenchrus echinatus*—which is even more common. Its almost globular fruits, armed with small but sharp and barbed spines, are almost sure to be picked up on the clothing during a walk on any dam. This method of transport is a very efficient one and by its means a wide distribution is ensured.

WATER CARRIAGE.

Water is another agent in the distribution of fruits and seeds. We have already had occasion to notice the fruits of the *Rhizophora*, which are long, club-shaped and pointed, and undoubtedly are able to stick into soft, muddy ground, if they happen to fall from the tree at the right moment. The advantage to the plant of having its fruit planted in its immediate neighbourhood is, however, not very obvious, and as a matter of fact this particular mangrove tree is most at home on the banks of rivers where *moving water* is to be found at most hours of the day. The fruits, when they fall, will be carried off by the current, and will be deposited in some backwater. They float vertically, but even if they are thrown up anyhow on the mud, they eventually twist themselves into an upright position, the top end growing upwards and the roots sent out from the lower end growing vertically downwards. The fruits and seeds of most plants

growing in the neighbourhood of water, float, so far as we have investigated the point—try *Avicennia* fruits, Crab nuts, (the oil these contain seems to be an effective "flotation mechanism,") seeds of the Nanny-foot Convolvulus, (what is the flotation mechanism in this case?) and any others you come across, including the Coconut. The power this last has of resisting the action of sea-water owing to its thick, fibrous husk, is popularly supposed to account for the wide distribution of the coconut among the islands and coastlands of the tropics. You must remember that even in *still water* a floating fruit or seed will be driven along by the wind. Note at which end of the pools along the shores of this colony the greatest growth of young Courida is to be found This will apply to all open swamps and wet savannah land.

WIND AS AN AGENT OF DISPERSAL.

Many fruits and seeds depend on wind carriage only. Refer again to the common "Soldier's Tassel" and the Wild Ipecacuanha: note the Silk-cotton and the Mahogany: and spend some time in investigating the extremely pretty mechanism of the Long John or "Xmas Candle" (*Triplaris surinamensis*). From this last case you will understand how even parts of the flower may be called in to reinforce the fruit: in the case of seeds, the wings are frequently outgrowths of the testa. Many seeds are carried by the wind simply because they are small and light. In this way some epiphytes, such as Orchids, are distributed. The wind, too, which can propel floating objects on water, can drive small seeds and fruits along the ground; and some plants have developed a "censer" mechanism by which the seeds are thrown out of the fruit only when the wind is strong, when of course the seeds will have a good chance of being blown some distance from the parent plant. Study the *Sesuvium* which is to be found on all new sand reefs along the shore, and note where the young seedlings spring up most profusely. Now recall the experiment with the Canna seeds which we suggested at the commencement of this lesson. What result did you note?

THE WORK OF BIRDS.

A remarkable method of dispersal is found in the "Old Man's Beard" (*Tillandsia usneoides*) which is to be seen

hanging in gray-green masses on trees in this colony. The plant, which seldom flowers, is made up of short pieces which easily break apart and may be carried some distance by the wind, when the stiff, curved leaves may catch on rough bark or thin twigs; but these may also be transported by birds (we have never been able to confirm this from personal observation) which use them for building their nests. Birds—and bats—are evidently important agents in distributing seeds, which may be swallowed and, if sufficiently hard and indigestible, may pass through the alimentary canal of the bird unharmed (have you ever noticed Guava seeds in birds' droppings?) or may be rejected after the bird or bat has eaten the edible part of the fruit. Some discussion took place at one time as to which of these methods was utilised by the Bird-vine (*Loranthus*), and perhaps your own observation can decide the point. Unfortunately this pest is most efficiently distributed, although its sticky seeds may be encountered in the most unlikely and unpromising places. Many edible fruits turn red when ripe, and thereby make themselves conspicuous—red showing up very plainly against green (did you ever wonder why cricket-balls are coloured red?) We have already referred to the Baby Cucumber (Lesson V), but many other instances will occur to you. It is evidently an advantage to the plant which depends on birds for the dispersal of its seeds to advertise when its fruits are ripe and edible.

(*To be Continued.*)

Rice.

It is indeed remarkable that the cultivation of rice should have been so long neglected, not only in Ceylon, but also in other countries. In the more temperate rice growing centres, in Italy and Japan for example, attention has been given to this matter for many years now, and in the case of the former, at least, with excellent results. More recently, tropical countries have followed their example and in India, British Guiana, Annam, and the Phillippines, investigations are now in progress, while Java, with its accustomed thoroughness, has instituted an Experiment Station specially devoted to rice.

—"The Tropical Agriculturist": November, 1916

Land and its Cultivation.

Left to itself, land usually produces abundantly if the rainfall is a fair one, but the vegetation is not of the class that is desired by the civilised man, and it is therefore the first business of the grower to destroy the class of vegetation the soil would naturally produce, and to make it the means by which more desirable plants can be raised. The initial object of ploughing, therefore, is to destroy that which is already growing upon the land, and to turn it under so that it will be out of the way of subsequent operations. Its decay in that position will improve the physical qualities of the soil, and will provide the crops with plant food.

It is one object of ploughing that it will be possible at a later stage to reduce the surface soil to a fine tilth by the use of harrow and cultivator, and it sometimes happens, especially on new land, that though that which previously grew on the surface has been effectively turned under, the finer implements cannot be employed until a second ploughing at right angles to the first has been given. A fine seed bed, prepared in a cheap and effective way, must ever be kept in view as one of the objects of tillage.

MOISTURE.

Another effect of ploughing is to enable moisture, whether supplied naturally or artificially, to sink through the surface soil into the subsoil where it may remain for a considerable time, whereas on unploughed land a large proportion must either run off or be dried up by sun and wind before it can sink into the subsoil. Soils vary much in their capacity to hold moisture while yet remaining arable and in good physical condition, and on the other hand plants also show a considerable range of adaptability. It is possible for a soil to contain from 20 to 25 per cent. of water and yet not be too moist for cultivation, while on the other hand plants are able to maintain themselves and grow when the soil contains only 6 to 8 per cent. of moisture.

DEEP CULTIVATION.

The storage capacity of a soil is so much increased by deep cultivation, that this becomes one of the chief reasons for

subsoiling. If a heavy rain falls on land that has been worked 4 inches deep the tilled soil is in danger of being water-logged. On the other hand, land that has been worked to a depth of 12 inches can absorb a much larger rainfall without becoming too wet, simply because the deep working has provided such a large quantity of loose friable soil to take up the moisture. Just as a large sponge will hold more water than a small one, so a big bulk of tilled earth will hold more water than a small bulk of it. One effect is that the surface of the deeply worked soil can be loosened soon after rain. Moreover, the disadvantages of shallow ploughing are increased by the readier loss of moisture, partly because so much is retained near the surface within reach of sun and wind, and partly because in most situations the surplus can escape so much more easily by run-off or gravitation. How much more quickly the crop will feel the effect of dry weather when the ploughing has been shallow, is apparent.

SOIL AIR.

Yet another effect of cultivation of the soil is the admission of air. Unlikely as it may appear, air is as essential to fertility as water. If a soil is compact, and if its interstices are filled with water or with fine silt, it cannot contain the air that the roots of plants require, and that is necessary to the minute organisms, called soil bacteria, that play an important part in the preparation of plant food. Moreover, it is possible for there to be too much air near the surface and too little below, with the result that while seed may germinate satisfactorily, the plants may not do as well as they should when the roots strike downwards. Cultivation aerates the soil, but it must be carried deep enough for the plant roots to get all the air they require.

TEMPERATURE.

The disturbance of the soil, too, has some effect upon its temperature. If the connection of the surface soil with that just below is interrupted by the plough or other implement, the great heat of the sun in summer, for instance, cannot be so readily communicated to deeper levels. The most important action in this connection, however, is the improvement in soil temperature in spring as a result of cultivation.

A soil saturated by winter rains will be kept cold in spring by the rise to the service of the water stored below; cultivation, however, will break the connection as just stated, and prevent the rise of the water, so that the surface soil will dry to a certain extent, and be the more quickly warmed by the action of the sun. The value of this where early, quickly grown, spring vegetables are desired for the market needs only to be indicated.

Before leaving this issue of the importance of deep and thorough preparation of the land, it is not out of place to remark that there are soils that are of such close texture that water passes very slowly through them. To have water standing thus upon the land is clearly unfavourable—it literally "drowns," or threatens to drown, the plants and the soil bacteria—and, if it is at all possible to avoid them, areas that have such deficient natural drainage should not be used for vegetables. In fact, with such extensive areas, suitable in most other respects, as we have in New South Wales it is unlikely that swampy lands will require to be handled for a considerable time. Where however, the condition has to be dealt with, only deep, open, or underground drains can be recommended. Their effect is to carry off the surplus water, to permit air to pass through the interstices of the soil, and to facilitate the drying up of some of the excessive moisture

"HARD-PAN."

An unsatisfactory condition can be set up in some soils by constant ploughing at the same depth, the result being the formation of what is called a hard-pan which is a band or thin layer of soil that has become so compacted that moisture passes too slowly through it (both downward and upward), and through which the roots of many plants strike with difficulty. In some districts the effect of hard-pan is to produce a condition much resembling that just described as needing drainage. Needless to say, all that is required in such a case is that the plough be set an inch or so deeper, so as to break up the solidified layer, and thereafter regularly to alter the depth of ploughing each year, going sometimes slightly deeper, and sometimes slightly shallower than what is deemed a desirable mean.

SURFACE CULTIVATION.

In addition to the deep cultivaton so far kept in mind, it may be pointed out that the moving of the top inch or two of soil has also important functions. Generally speaking, surface cultivation is carried out in gardens for the purpose of destroying weeds, but it also tends to conserve moisture —indeed, so valuable and appreciable are its effects in this direction that, even in the absence of weeds, the surface must be kept in a loose and friable condition.

Exhaustive experiments have proved, that to disturb the top soil prevents moisture from rising to the surface, where sun and wind can carry it off by the process of evaporation. The effect of neglecting the surface in summer, in fact, is simply to allow the moisture (so precious at that time of the year) to escape into the air, and the only convenient way of preventing that is to maintain a dry, loose surface, freshening it every time rain, irrigating or tramping sets it down again. The top 12 or 18 inches of soil are the most important to plant life, but beneath that is usually stored a reserve of water which is conducted to the surface by fine capillary tubes. Once the connection between subsoil and surface is established, and capillary action can proceed freely, the moisture below will rise steadily to the surface, where it will pass off into the air. The gardener who wishes to be successful must register a resolution that, so far as his property is concerned, compacted and neglected surfaces shall not be tolerated—that, in other words, loss of moisture by capillarity and evaporation shall be reduced to a minimum.

MULCH.

While a soil mulch is perhaps the most convenient method of preventing evaporation, stable manure and straw are also largely used for the purpose, their effect being to prevent the sun and wind from too close contact with the soil surface. In raised beds, where it is often difficult to maintain the sides in a loose condition without constant washing down, the sides should be covered with some mulching material in order to prevent loss of moisture.

The only time when the gardener should excuse in his own mind any loss of moisture, is in the germination of fine

seeds. It is then necessary, in order to obtain a good percentage of germination, to bring the soil to a fine tilth, and to roll it after sowing the seed. This brings the moisture to the surface, by consolidating the soil so that the capillary movement of the subsoil moisture is set up; germination is thus ensured. But even in such cases the surface should be broken as soon as the plants are established. In the case of seeds (such as onions, etc.,) sown by a hand seed-sower, the rolled portion between the rows should be disturbed immediately after sowing.

—"The Agricultural Gazette of New South Wales."

Keeping up with the Times.

In order that there shall be a reasonable chance of our being able to maintain our place in the world it is above all necessary that we should move with the times. We are a long way from the eighteenth century—when a sound education in classics was recognised as the be-all and end-all of a boy's upbringing. Science was then in its infancy. Throughout the nineteenth century it was advancing by leaps and bounds. In this twentieth century we meet it at every turn; there is no getting out of its path. That this is truly the age of science we have no lack of evidence in the present war, but the statement is no less true and is even more important in its application to the occupations of peace. And if we wish to live up to our age we must do what in us lies to promote the progress of science. The mere diffusion of scientific knowledge throughout the community will be directly beneficial; but, besides this, certain important consequences must follow such diffusion. Not the least of these is the capability of appreciating the fact that it is necessary for our prosperity—nay, for the continuance of our very existence—that in every possible way knowledge of science should be advanced. Let us make no mistake on this point. The nation which recognises this necessity will succeed, the nation which refuses to recognise it will fail.—"**Nature,**" May 18, 1916.

Food Plants of British Guiana.

3y Professor Harrison, C.M.G., M.A., Director, and C K. Bancroft, M.A., F.L.S., Assistant Director, of the Department of Science and Agriculture.

This colony lying between latitude 0° 41′ N. and 8° 33′ 22″ N., has a depth from North to South of about 500 miles, a ;eaboard of about 270 miles and occupies in the north-east of South America an area approximately equal to that of Great Britain.

The chief agricultural industries are sugar, rice, cacao, cof-'ee, coconuts, rubber, limes and ground provisions. The prin-'ipal exports derived from these are sugar and its by-)roducts (rum, molasses and molascuit) rice, coffee and :oconuts. But in addition to the plants from which this)roduce is obtained there are a large number of species vell suited both to the soil and the climatic conditions of the :olony, which would repay cultivation on a much larger ;cale than exists in the colony at the present time. British Guiana imports large quantities of foodstuffs of vegetable)rigin, prominent among which are grain and flour, ground)rovisions of various kinds, more particularly potatoes, both)rdinary and sweet, pulses, fruit, cattle foods, etc. The ıverage annual value of the imports of food, including drink ınd tobacco, for the past three years, has considerably ex-'eeded half a million pounds sterling. The continuance of he present war has led not only to the increased cost of 'oodstuffs but also to an actual shortage of certain articles)f food, which will doubtless become much more keenly felt ıs the year goes on.

In the following pages of this article will be given a list)f the food plants occurring in British Guiana with short ıotes on their uses. These, if planted in sufficient quantity ınder suitable conditions and properly tended would not)nly render this colony independent of any external supply)f vegetable food, but would leave a large surplus for export ;o other countries. The plants are dealt with under two

heads, *viz.*, I., Field Crops, Vegetable and Miscellaneou Plants, and II. Fruits and Spices.

EXPRESSION OF FOOD VALUE.

The difference in the capacity of different foods for yiel ing heat or energy renders it desirable to express the fuel o food value of each either in terms of an absolute unit, as th calorie, or in terms of an arbitrary expression depender on the relative proportions in which the nutritive constitu ents are present. In the former case the fuel value is th amount of heat, expressed in calories, equivalent to the energ which could be obtained if all of the nutrients present we thoroughly digested. The latter are usually expressed a "Nutritive Ratio" (N.R.) by which is meant the proportio that the sum of the starch or carbohydrate content and tw and a half times the fat content bears to the crude protei content taken as unity, *i.e.*, $\frac{\text{Carbohydrate} + 2{\cdot}5\ \text{Fat}}{\text{Protein}}$: "Fat Ratio (F.R.), the proportion that the starch or carbohydrate conten bears to the fat content taken as unity, *i.e.*, $\frac{\text{Carbohydrate}}{\text{Fat}}$: "Foo Units" (F.U.), the sum of the starch or carbohydrate conten added to two and a half times the sum of the fat and protei content, *i.e.*, Carbohydrate + 2·5 (Fat + Protein).

The value of a calorie in terms of Rubner's units (R.C. is obtained by multiplying the sum of the Protein and Carbo hydrates by 4.1 and adding the result to the Fat multiplie by 9.3, *i.e.*, 4.1 (Carbohydrate + Protein) + 9·3 Fat.

Wherever it has been possible to do so the fuel value an the other values mentioned above have been included in thi article. The most valuable of these expressions are the fue value in Rubner calories and the "Nutritive Ratio."

I.

FIELD CROPS, VEGETABLE AND MISCELLANEOUS PLANTS.

Aniseed: *Tragium anisum.* An annual herb, native o Egypt, employed for garnishing dishes, grown in kitche gardens, but only in small quantity. It is propagated fro the seed, which may be sown in a box or pan. The youn

plants when strong enough may be transplanted into a bed about six inches apart.

Arrowroot: *Maranta arundinacea.* A perennial herb native of tropical America, growing to a height of about three feet, possessing fleshy rhizomes from which the arrowroot of commerce is obtained. Although it is not cultivated now in British Guiana to any appreciable extent, there was some fifteen years ago a cultivation of fair size on the West Coast of Berbice. The plant requires a light well-drained soil. A return may be expected eleven months after planting. The rhizomes contain about 20-25% of starch, but little more than 15-18% is usually recoverable, yielding 7 cwt. of arrowroot per acre. Under very favourable conditions this return may be doubled.

The average compositions of the arrowroot plant and starch are:—

	Plant.	*Starch.*
Moisture	63.4 ..	13.6
Protein	1.6 ..	.9
Fat	.2 ..	.3
Starch, Sugar, etc. ..	30.0 ..	84.6
Fibre	3.9 ..	.3
Ash	.9 ..	.3
N.R.	19.0 ..	9.5
F.R.	150.0 ..	282.0
F.U.	34.4 ..	88.0
R.C.	131. ..	353.

Artichoke: *Helianthus tuberosus.* The Jesusalem artichoke is the tuber of a perennial sun-flower-like plant, native of Canada and the middle parts of the United States of America. The tubers may be cut to single eyes and planted like a potato. The plant requires a friable loamy soil for its successful cultivation. A crop can be obtained three months after planting. The composition of the tuber is:—

Moisture	80.0
Protein	2.0
Fat	5
Starch, Sugar etc.	14.4†

† Sugar, inulin and levulin.

Fibre	2.0
Ash	1.1
N.R.	7.8
F.R.	28.8
F.U.	20.6
R.C.	72.

Asparagus (*Asparagus officinalis.*) A perennial ere herb, said to be indigenous to Europe and Asia, growing a height of 3-4 feet, cultivated for its young tender shoot In kitchen gardens on loose soil it makes a fair growth, bu the shoots seldom attain a satisfactory size.

Asparagus Bean—see Bean, Yard.

Bamboo: *Bambusa* spp. The young shoots of son species are used in making pickles and chutney.

The seeds of *Bambusa arundinacea* have been employed i India on several occasions to substitute a deficient millet rice crop. Their composition when husked is:—

Moisture	11.0
Protein	11.8
Fat	.6
Starch, Sugar, etc.	73.7
Fibre	1.7
Ash	1.2
N.R.	6.4
F.R.	122.8
F.U.	104.7
R.C.	356.

Basil: *Ocymum basilicum.* Said to be native of the Ea Indies. Useful for seasoning, like sage or thyme. The see should be sown in boxes and the young plants transplant to a well-drained bed.

Beans—Bonavist: *Dolichos Lablab.* Annual or perenni twining vines. The most useful is a small annual. Th beans are employed as a vegetable.

Dholl: *Phaseolus Mungo.* The green pods and ri seeds are eaten.

Beans—Goa: *Psophocarpus tetragonolobus.* A perennial climber bearing fruit from 9-10 inches long, each with four wings. The pods when immature are sliced and cooked like French or Kidney beans. Introduced into the colony from India.

Guar: *Cyamopsis psoralioides.* A robust annual, probably native of India. The pods are employed in the same manner as the above.

Kidney or French: *Phaseolus vulgaris.* An annual, cultivated for its edible pods which are used as a vegetable when immature. Several varieties occur.

Lima: *Phaseolus lunatus.* A robust annual, cultivated for its edible seeds.

Scarlet Runner: *Phaseolus multiflorus.* A perennial climber whose pods are used like those of the Kidney bean.

Soya: *Glycine Soya.* A sub-erect annual herb, native of Southern Europe, culitvated for its edible seeds.

Sword: *Canavalia ensiformis.* An annual climber, the ripe seeds and immature fruit of which are employed as vegetables.

Yard Long: *Dolichos sesquipedale.* An annual climber sub-erect, with flexuose stems. The immature fruit and seeds are eaten as a vegetable.

The above beans yield returns in from three to six months. They are the commonest beans suitable for cultivation in kitchen gardens in the colony. There are several others cultivated in tropical countries which may with advantage be grown in this colony, such as Sutri (*Phaseolus calcaratus*) Tepary (*Phaseolus acutifolius*), Moth (*Phaseolus aconitifolius*) Ngena (*Phaseolus* sp.), Horse (*Dolichos biflorus*), Velvet (*Stizolobium aterrimum*) Bambarra (*Voandzeia subterranea.*)

The following table shows the composition and the food value of some of them:—

	IMMATURE PODS.	BEANS.				
	Kidney.	*Bonavist.*	*Dholl*	*Lima.*	*Soya.*	*Sword.*
Moisture	89·8	14·6—12·1	10·8	13·3	10·3	12·6
Protein	2·4	17·1—22·4	22·2	19·7	43·6	25·0
Fat	·4	1·4—2·3	2·7	1·2	15·5	2·8
Starch, Sugar etc.	1·8	53·5—57·4	54·1	57·8	21·0	48·6
Fibre	4·8	5·0—6·5	5·8	4·3	4·4	7·7
Ash	·8	3·4—3·7	4·4	3·7	5·2	3·4
N.R.	1·2	3·3—2·8	2·7	3·1	1·4	2·2
F.R.	4·5	38·0—25·0	20·0	48·2	1·4	17·3
F.U.	8·8	99·8–122·3	116·4	109·9	168·7	118·1
R.C.	21·0	300·—351·	338·	329·	409·	328

Boulanger: *Solanum Melongena.* An erect, herbaceous annual, 2-3 feet tall, bearing roundish-oblong purplish fruits, forming an important vegetable in this colony. Grown readily from seed. The plant requires a friable loamy soil.

Breadfruit: *Artocarpus incisa.* A native of the Pacific Islands grown in fair quantity in the colony. An evergreen tree bearing large round fruits employed as a vegetable. The tree is best grown on a friable soil of good depth. The compositions of meal and flour made from the fruit are as follow:—

	Meal.	*Flour.*
Moisture	12.1-13.9 ..	14.3
Protein	3.5- 5.3 ..	1.0
Fat	1.3- 1.4 ..	.2
Starch, Sugar, etc. ..	77.1-61.6 ..	83.8
Fibre	4.0-14.8 ..	.2
Ash	2.0- 3.0 ..	.4
N.R.	24.2-12.3 ..	84.3
F.R.	6.0-44.0 ..	419.0
F.U.	89.0-78.4 ..	86.8
R.C.	342. -287 ..	390.

Cabbage: *Brassica oleracea.* A biennial herb, native of Europe, grown as an annual for its succulent leaves which form a "head." The composition of the shoots and leaves is:—

	White.	Red.
Moisture	90.1	90.0
Protein	1.8	1.8
Fat	.2	.3
Starch, Sugar, etc.	2.8	2.5
Fibre	3.9	4.6
Ash	1.2	.8
N.R.	1.83	1.77
F.R.	14.0	8.3
F.U.	7.8	7.7
R.C.	21.	20.

Cabbage Palm: *Oreodoxa oleracea.* A tall erect palm whose immature inflorescences are used in the making of pickles.

Calalu. Giant cockscomb: *Celosia cristata,* var. *major.* An erect herb growing from 3-4 feet high. The young leaves are employed as a spinach. It is said to be the best of all calalus

Green: *Amaranthus viridis.* An erect herb occurring in two varieties, a larger and a smaller. The tops of the shoots are used as a spinach.

Indian Kale: *Xanthosoma atrovirens.* A low-growing perennial. The young leaves are used as a spinach.

Kale: *Colocasia nymphaefolia.* Similar to the above.

Spanish: *Phytolacca octandra.* A succulent plant with a trailing stem employed as a spinach.

Water: *Colocasia antiquorum.* Similar to Kale.

The compositions of the shoots of Indian Kale and Spanish Calalu are:—

	Indian Kale	Spanish Calalu.
Moisture	89.4	95.5
Protein	2.5	1.1
Fat	.8	.2
Starch, Sugar, etc.	4.6	1.7

	Indian Kale	Spanish Calalu.
Fibre	1.1	.3
Ash	1.6	1.2
N R.	2.6	2.1
F R.	5.7	8.5
F U.	12.9	4.9
R.C.	36.	13.

Carrot: *Daucus Carota*. A biennial herb, native of Europe, cultivated as an annual for its edible roots. The plant is best grown on a loose friable or sandy loam.

Carrot roots have the following composition:—

Moisture	90.3
Protein	1.2
Fat	.3
Starch, Sugar, etc.	4.6
Fibre	2.6
Ash	1.0
N.R.	4.4
F.R.	15.3
F.U.	8.3
R.C.	26.

Cassava: *Manihot utilissima*. A perennial, woody herb, growing with an erect stem up to 9 feet in height, native of tropical America, cultivated for its tuberous roots from which bread, starch and other products are made. It is one of the principal sources of carbohydrate food in the colony. A crop is obtained in 9-11 months, and produces 4-8 tons of tubers per acre. There are two kinds, the "bitter" and the "sweet." The former is more hardy and gives the higher returns per acre. The compositions of cassava and its products are:—

	Roots.	*Meal, dried.*	*Chips, Kiln dried.*	*Bread.*	*Starch.*	*Bitty.*	*Tapioca.*
Moisture	64·4	11·4	·6	10.2	15·8	10·9	13·7
Protein	1·4	2·1	1.3	1·3	·4	3·6	·5
Fat	·4	1·1	1·6	·6	·2	·7	·3
Starch, Sugar, etc.	30·4	82·1	91·8	81·9	83·4	76·0	84·1
Fibre	2·7	1·8	2·9	4·8	...	6·1	·7
Ash	·7	1·6	1·8	1·1	·2	2·7	·7

	Roots	*Meal, Dried.*	*Chips, Kiln Dried.*	*Bread.*	*Starch.*	*Bitty.*	*Tapioca.*
N.R.	22·4	40·4	73·7	64·3	192·0	21·7	184·4
F.R.	76·0	74·6	51·1	131·7	417·0	108.6	280·3
F.U.	34·9	90·1	99·9	86·8	85·6	86·8	86·0
R.C.	134	355	383	348	345	333	348

Celery: *Apium graveolens.* A biennial herb, native of Europe, cultivated for its leaf-stalks which are eaten cooked or uncooked.

Chrystophine: *Sechium edule...* A perennial climber bearing furrowed fruits, 3-4 inches long, employed when immature as a vegetable.

Corn. Guinea: *Sorghum vulgare.* An annual grass, native of India, extensively cultivated in the West Indies but only in very small quantity in British Guiana. The high food value of the grain renders it an important article of food in several countries in the world. A good average return from an acre is 50 bushels of grain. It gives a crop in about five months. Although it will give good returns on a wide range of soils, it thrives best on a loose friable one. An average composition of the grain is:—

	Not Hulled.	*Hulled.*
Moisture	10.5	12.0
Protein	7.5	8.0
Fat	1.6	2.0
Starch, Sugar, etc.	67.4	76.4
Fibre	9.0	1.0
Ash	4.0	1.0
N.R.	9.5	10.1
F R.	42.1	38.0
F U.	90.1	101.0
R C.	322	362

Imphee: *Sorghum saccharatum.* One of the millets closely allied to the above.

Indian or Maize: *Zea Mays.* An annual grass, whose grain is an important article of food in several parts of the world. It yields a crop in 4 months of 16-25 bushels

per acre. The following are average compositions of maize products:—

	Flour.	*Meal.*	*Cornflour (Starch).*	*Bran.*
Moisture	12·6	9·7	14·1	12·5
Protein	8·7	12·7	·9	9·9
Fat	2·0	1·2	1·2	3·6
Starch, Sugar etc.	74·7	74·5	83 6	61·5
Fibre	1·0	·3	·1	9·5
Ash	1·0	·6	·1	2·8
N.R.	9·2	5·9	96·2	7·1
F.R.	37·3	62·1	70·0	17·1
F.U.	101·7	106.2	88·8	95·3
R.C.	361	356	357	326

Cucumber: *Cucumis sativa.* A herbaceous climber, probably native of the East Indies, cultivated for its fruits which are used as a vegetable when immature.

The composition of the immature fruit is:-

Moisture	96.5
Protein	.5
Fat	.2
Starch, Sugar &c....	1.5
Fibre	.8
Ash	.5
N.R.	4.0
F.R.	7.5
F.U.	3.2
R.C.	10.

Dholl.—see Bean, *Phaseolus Mungo.*

Eddoe.—*Colocasia esculenta.* A perennial herb, native of India, cultivated as an annual for its rhizomes which are starchy. It yields a crop in 9-12 months of 1½ to 2 tons of tubers. An average composition of the tubers is:—

Moisture	91.6
Protein	.3
Fat	.1
Starch, Sugar &c....	5.0
Fibre	1.7
Ash	1.3

N.R.	...	...	...	...	17.7
F.R.	...	...	...	...	50.7
F.U.	...	...	...	...	6.0
R.C.	...	...	...	...	22.

Egg-plant.—see Boulanger.

Endive.—*Cichorium Endiva*: An annual herb grown for its leaves which are employed in a similar manner to lettuce in the making of salads.

Fennel.—*Foeniculum vulgare*: A perennial, native of Europe, employed for garnishing dishes like parsley.

French Bean.—see Bean, French.

Garlic.—*Allium sativum*: A perennial herb, cultivated for its bulbs which are employed for seasoning.

Giant Cockscomb.—see Calalu.

Ginghee.—*Luffa acutangula*: A herbaceous climber, producing green fruits which are eaten as a vegetable when immature in a similar manner to squash.

Goa.—see Bean.
Gourd.—*Luffa cylindrica*: Similar in appearance and uses to Ginghee.

Green Calalu.—see Calalu.

Ground Nut.—*Arachis hypogaea*: An anual herb, grown for its oily seeds. An oil used in cooking is expressed from the seeds. The yield per acre of shelled seed is about ½ to ¾ ton, a crop being obtained 4—5 months after planting. The composition of the seed is:—

Moisture	...	...	...	7.5
Protein	...	...	...	27.5
Fat	...	...	...	44.5
Starch, Sugar, etc.		...	...	15.7
Fibre	...	...	...	2.4
Ash	...	...	...	2.5

N.R.	4.6
F.R.	.3
F.U.	195.6
R.C.	591

Guar Bean.—see Bean.

Guinea Corn.—see Corn.

Hog Tannia: *Colocasia indica*: Similar to the Tannia, but stronger and coarser in growth and with a bare stem of 2 to 3 ft. high. The plant does not produce many tubers. The whole stem is used for food. The composition of the root-stock is:—

Water	91.56
Oil, Fats	.08
Albuminoids	.27
Sucrose	trace.
Glucose	.36
Starch	.94
Gums, Pectose, etc.	1.11
Fibre	4.49
Ash	1.19

Horse Radish.—*Cochlearia Armoracia*: A perennial herb, native of Europe, cultivated for its fleshy roots which are employed for garnishing dishes.

Imphee.—see Corn.

Indian Corn.—see Corn.

Job's Tears.—*Coix Lachryma-Jobi*: An annual grass bearing hard rounded grains, 3 to 5 feet high. The food value of the grains husked is shown in the following table:—

Moisture	15.8
Protein	18.8
Fat	6.2
Starch, Sugar, etc.	59.6
Fibre	1.3
Ash	3.4
N.R.	4.1
F.R.	9.6

F.U.	...	125.2
R.C.	...	379

Kale.—see Calalu.

Kidney Bean.—see Bean.

Kohl-Rabi.—*Brassica oleracea* var. *caulo-rapa*: A biennial, ıltivated as an annual for its fleshy underground stem hich is employed as a vegetable. The composition of the ıber is:—

Moisture	86.7
Protein	2.9
Fat	.3
Starch, Sugar, etc.	8.3
Fibre	.6
Ash	1.2
N.R.	3.1
F.R.	27.7
F.U.	16.2
R.C.	49

Leek.—*Allium Porrum*: A perennial herb, native of urope, cultivated as an annual for its fleshy leaves and ems.

Lettuce.—*Lactuca sativa*: A herbaceous annual whose succlent leaves are used in making salads and for similar ırposes.

Loofah.—see Gourd.

Lotus.—*Nelumbium speciosum*: A perennial herb, aquatic, ›aring large seeds embedded in a cone-shaped fruit. The eds are either eaten raw when immature or roasted when pe.

Their composition is:—

Moisture	12.2
Protein	17.7
Fat	2.4
Starch, Sugar, etc.	62.2

Fibre	1.7
Ash	3.8
N.R.	3.9
F.R.	25.9
F.U.	112.5
R.C.	350.

Manicole.—*Euterpe edulis*: A medium-sized palm whose terminal bud or "cabbage" is employed as a vegetable. It is of common occurrence near watercourses in several parts of the colony.

Mint.—*Mentha viridis*: A perennial herb, native of Europe, whose leaves are employed for flavouring purposes.

Mushroom.—*Agaricus campestris*: An edible fungus. A small variety may commonly be found in fields at certain periods of the year. It is of good flavour.

Nipa.—*Nipa fruticans*: A low-growing swamp palm with large leaves, yielding a sap obtainable from the young inflorescence from which sugar and a spirit known as "arrack" are made.

Okra.—*Abelmoschus esculentus*: An annual coarse herb bearing edible pods which are used as a vegetable when immature. The composition of the pods is:—

	Range of Composition
Moisture	80.7-90.2
Protein	1.6- 4.2
Fat	.2- 4
Starch, Sugar, etc.	4.0-12.1
Fibre	1.2- 3.4
Ash	.6- 1.4
N.R.	2.8- 3.1
F.R.	20.0-32.5
F.U.	8.5-23.6
R.C.	24. -62.

Onion.—*Allium Cepa*: A perennial herb, cultivated as an annual for its fleshy bulbs which are employed for seasoning purposes.

Parsley.—*Carum Petroselinum*: A herb, native of Europe, used for garnishing dishes.

Pea.—Blackeye: *Dolichos sphaerosperma*: An annual climber whose seeds are used as a vegetable.

Cow: *Vigna Catjang*: An annual, bean-like, rambling vine. The pea furnishes a good human food.

Increase: Similar to Cow Pea in habit and uses.

Pigeon: *Cajanus indicus*: A perennial shrub whose seeds are eaten when nearly mature. It gives a crop in 11—12 months of 3—4 cwt. per acre. The composition of the peas is:—

Moisture	10.5
Protein	22.3
Fat	2.1
Starch, Sugar, etc.	60.9
Fibre	1.2
Ash	3.0
N.R.	2.9
F.R.	29.0
F.U.	121.9
R.C.	361.

Pepper: *Capsicum annuum*: Herbaceous or shrubby annuals or perennials, natives of tropical America, cultivated for their fruits which are employed principally for dressing dishes.

Pumpkin.—*Cucurbita Pepo*: An annual climber, grown for its large fruits which are employed as a vegetable. A vine yields under favourable conditions a crop in about 6 months of 2 cwt. of fruit. The composition of the fruit is:—

Moisture	88.9
Protein	.7
Fat	.3
Starch, Sugar, etc	9.0
Fibre	.5
Ash	.6

N.R.	14.0
F.R.	30.0
F.U.	15.7
R.C.	42.

Purslane: *Portulaca oleracea*: A herb possessing succulent stems and leaves which are sometimes used in making salad. Grows wild in many parts of the colony. The composition and food value are similar to those of Calalu.

Rice: *Oryza sativa*: A member of the grass family; an annual cultivated for its grain, which constitutes a staple article of diet, introduced into British Guiana in 1782 during the French occupation. In 1898, only 6,500 acres of rice were under cultivation in the colony, while at the present time more than 60,000 acres are cultivated. The plant yields a crop in 4 to 5 months. In some parts of British Guiana two crops are obtained annually; with proper irrigation a return per acre of 42 cwt. of padi is obtained. The average return per acre over the whole colony over large areas is 32 cwt. The varieties of rice are legion: those cultivated most commonly in the colony are Demerara Creole, Berbice Creole, No. 75, and H. 6. The husked grain is employed in many ways as food—as a cooked vegetable, in cakes, bread, puddings, etc. The food values of padi and of rice are indicated in the following tables:—

PADI.

	General.	*Demerara Creole.*	*Berbice Creole.*	*No. 75.*	*Demerara Hill Rice.*	*Wild Indian.*
Moisture	12.6	13.6	10.3	13.1	12.3	11.9
Protein	6.1	6.5	8.4	6.6	6.5	9.8
Fat	2.0	2.2	2.9	2.3	2.6	.8
Starch, Sugar, etc.	74.1	64.9	68.6	64.0	66.2	73.3
Fibre	4.0	7.5	2.5	8.6	6.9	2.1
Ash	1.2	5.3	3.4	5.4	5.5	2.1
N.R.	13.0	10.8	9.0	10.6	11.2	7.6
F.R.	37.0	29.5	23.6	17.8	25.5	91.6
F.U.	94.8	86.6	96.9	86.3	89.4	99.8
R.C.	347	313	343	311	332	348

MILLED RICE.

	British Guiana. White	Rangoon. White	Carolina. White	East Indian. White	East Indian. Brown	Japan Brown	Polished.
Moisture ...	11.2	14.4	12.2	12.7	12.0	11.1	12.4
Protein ...	7.8	6 9	7.8	6.9	8.0	8.5	7.5
Fat ...	.5	.5	.4	2	2.0	1.9	.4
Starch, Sugar, &c	79.4	77.6	78.9	79.1	76 0	76 0	78.8
Fibre ...	.3	.1	.3	.3	1.0	1 0	.4
Ash ...	8	.4	.5	.6	1.0	1.5	.5
N.R. ...	10.3	11.4	10.2	11.5	10.1	9.5	10 6
F.R. ...	159 0	155.2	197 2	395.5	38 0	40.0	197.0
F.U. ...	100.0	96 2	99.4	97.0	105 0	102.	98.5
R.C. ...	362	351	359	354	363	364	357

Sage: *Salvia officinalis*: A herb employed for flavouring.

Sago: *Metroxylon Rumphii*: A palm of medium size whose trunk yields the sago of commerce. The range of composition is:—

	Ordinary Sago.	Pearl Sago.
Water ..	12.81—16.8 ..	12 —15
Protein ..	.2— 2.1 ..	——
Fat	.1— .2 ..	——
Starch, Sugar, etc.	77.0—82.3 ..	84.9—87.8
Fibre	.1— 4.0 ..	——
Ash	.6— 3.8 ..	.1— .2

Seaside Purslane: *Sesuvium portulacastrum*: A succulent herb, commonly found on the coastlands of the colony. The stems are used as a vegetable. The composition and food value are similar to that of Calalu.

Scarlet Runner: see Bean.

Shallot: *Allium ascalonicum*: A perennial herb grown as an annual for its fleshy bulbs which are employed for flavouring purposes in a similar manner to the onion.

Soya: see Bean.

Spanish Calalu: see Calalu.

Squash: *Cucurbita maxima*: A herbaceous climber producing fleshy fruits which are used as a vegetable. The composition and food value are similar to those of the cucumber

Sugar Cane: *Saccharum officinarum*: A member of the grass family cultivated for the sugar-containing sap or "juice," contained in the stems, from which the cane sugar of commerce is manufactured. The plant is grown on a large scale in the colony, nearly 80,000 acres being cultivated. More than one-third of the colony's population is directly engaged in the industry. Sugar and its by-products, rum, molasses and molascuit contribute 80% of the total value of the exports of British Guiana. The plant yields a return in 14 months. An average return for the colony is 1.8 tons of cane sugar per acre.

Sweet Potato: *Ipomoea Batatas*: A perennial creeper, natice of tropical America, cultivated as an annual for its tuberous roots. A crop is obtained in 4 to 5 months of 2 to 4 tons of roots per acre. The plant is propagated by cutting up the tubers which produce numerous shoots, or by planting cuttings of the stem. The roots, which have a starch content of about 20% are employed as a vegetable. Composition:—

	Tuber.	*Meal.*	*Starch.*
Moisture	73.1 to 60.2	12.0	13.7
Protein	.6 „ 4.4	5.1	.8
Fat	.4 „ .8	1.2	.1
Starch, Sugar, etc. ..	13.3 „ 33.8	76.9	85.3
Fibre	.6 „ 17.8	1.9	
Ash	1.1 „ 1.3	2.9	.1
N.R.	7.7 „ 23.3	15.6	101.9
F.R.	33.2 „ 54.7	64.1	853
F.U.	15.8 „ 44.8	93.7	87.7
R.C.	112 „ 135	347	354

Talipot: *Corypha umbraculifera et* spp: A tall-growing palm flowering when 25 to 35 years old. Starch is obtainable from the trunk, as in the sago palm.

Tannia: *Colocasia macrorhiza*: A perennial herb grown as an annual for its starchy tubers. A crop of 1½ to 2 tons per acre is obtainable in 9 to 12 months. The plant is

propagated by planting small tubers. The tubers, which constitute an important article of diet, have the following composition:—

Moisture	78.4
Protein	2.7
Fat	.3
Starch, Sugar, etc.	16.1
Fibre	2.0
Ash	.5
N.R.	6.2
F.R.	53.7
F.U.	23.5
R.C.	80.

Thyme: *Thymus citriodorus*: Used in the same manner as Sage.

Tomato: *Lycopersicum esculentum*: An annual coarse herb, native of South America, cultivated largely for its sub-acid fruits which are eaten cooked or uncooked. Propagated by seed which is sown in a box and transplanted to a well-drained bed. The fruits have the following composition:—

Moisture	93.4
Protein	1.0
Fat	.2
Starch, Sugar, etc.	4.0
Fibre	.8
Ash	.6
N.R.	4.50
F.R.	20.00
F.U.	7.00
R.C.	22.

Turnip: *Brassica rapa*: A perennial resembling the radish. The plant is not usually a success in the Tropics.

Water Calalu: see Calalu.

Yam: *Dioscorea alata*: A perennial climber introduced from the East, and cultivated for its edible tubers. Several varieties occur, the best of which is probably that known as

"Buck Yam." The plant yields a crop of tubers, in 9 to 11 months, of 1½ to 3 tons, which have the following composition:—

Moisture	74.0
Protein	2.0
Fat	.5
Starch, Sugar, etc., ...	20.0
Fibre	2.2
Ash	1.3
N.R.	10.6
F.R.	40.0
F.U.	26.2
R.C.	73.

Yard-long Bean: see Bean.

FRUITS AND SPICES.

Abai: see African Oil Palm.

Acquero: *Astrocaryum Tucuma*: A native palm bearing yellow fruits with an oily pericarp.

African Oil Palm: *Elaeis guineensis*: A medium-sized palm native of West Africa, whence it was introduced by slaves into this colony and planted in fair quantity near to the coastlands. An oil employed principally as a lubricant is extracted from the pericarp of the fruit. This oil is also used as a fat in cooking. The oil derived from the kernel is employed in the making of perfumes, etc.

Akee: *Blighia sapida*: A tree bearing bright scarlet fruits 2 to 3 inches long, said to be native of West Africa. The white inner portion of the fruits is eaten either alone or used in making a sauce.

Allspice: *Eugenia Pimenta*: The "Bay" tree of the West Indies which furnishes the allspice of commerce, consisting of the dried fruits. The produce is sometimes large. The odour and flavour of the berries, due to a volatile oil, resemble a combination of cinnamon, cloves and nutmeg, hence the name allspice. Allspice is largely used for flavouring purposes. The oil is occasionally employed as a carminative.

Almond or Seaside Almond: *Terminalia Catappa*: A tree producing oval-flattened fruits whose outer portion is edible.

Annatto: *Bixa Orellana*: A small tree bearing terminal clusters of spiny fruits containing small seeds used in colour ing cheese and butter. Widely distributed, but here of no commercial importance.

Arabian Coffee: *Coffee arabica*: A native of Abyssinia, cultivated for its seeds from which the best coffee is made. The plant is grown in fair quantity in the lower reaches of the rivers of the colony, but is not so well suited to the conditions of soil, climate and labour as another variety—Liberian. The plant yields a crop in three years, when grown under favourable conditions, of 4 to 8 cwt. of dry coffee per acre.

Areca: *Areca Catechu*: A tall-growing palm, cultivated for its fruits, which possess astringent and aromatic properties. Though not grown to any large extent in the colony it is very largely employed by certain Eastern races in their native homes.

Avocado Pear: *Persea gratissima*: A medium to large sized tree bearing rounded or bottle-shaped fruits, green or purple, which are either eaten alone or used in the making of salads. The tree does not flourish on the heavy soil of the front lands but at some distance from the coast, on lighter land with a good depth of drainage, it often yields large crops. The composition of the fruit is as follows:—

Flesh, 65%; Rind, 10%; Stone, 25%. The flesh contains about 1.7% sugar, 10.5% oil, 5.7% protein, 4% fibre, and 2% ash.

Awarra: *Astrocaryum tucumoides*: A palm resembling closely the Acquero.

Balata: *Mimusops globosa*: The small, rounded fruits are gathered and eaten by native Indians in the forest. The tree is widely distributed in the colony, occurring most frequently on rising ground away from the water's edge, on the middle reaches of the rivers, but not infrequently on low

land near the banks of creeks. The flowers emit an agreeable odour.

Banana: *Musa sapientum*: An annual possessing large leaves with well-developed sheaths, bearing elongated cylindrical fruits which are eaten fresh when ripe, or are sometimes dried and converted into meal or flour. Several varieties occur. The compositions of the fruits of two common varieties and of the meal and flour are:—

	Chinese.	*Jamaica.*	*Meal.*	*Flour*
Moisture	67.1	75.8	12.8	10.9
Protein	5.0	1.3	1.6	.7
Fat	.2	.3	.3	.2
Starch, Sugar, etc., ..	26.5	20.5	81.7	84.9
Fibre	.3	.7	.6	.7
Ash	.9	1.4	3.0	2.6
N.R.	3.5	16.3	49.1	120.0
F.R.	132.5	683.	172.3	424.5
F.U.	29.8	24.5	81.6	87.1
R.C.	131.	92.	344.	353.

Barbados Cherry: *Malpighia glabra*: A tree which is usually grown in the colony in hedges. It produces small, rounded acidulous fruits which are sometimes eaten fresh when ripe, but are more usually employed in the making of jams.

Barbados Gooseberry: *Pereskia aculeata*: A trailer bearing spines on the stem and young branches, and producing very acid fruits.

Bay Tree: see Allspice.

Betel Nut: see Areca Nut.

Bilimbi: *Averrhoa Bilimbi*: A tree native of India and China, bearing on the stem and branches numerous fruits resembling small cucumbers: employed in making pickles.

Brazil Nut: *Bertholletia excelsa*: A large tree bearing hard, rounded fruits containing 18 or more nuts which are of excellent flavour. Said to be native of Guiana, but only two trees (cultivated) are known to occur in this colony.

The kernels of the seeds have the following composition:—

Water	6.40
Fat	70.16
Albuminoids	12.33
Amides	.25
Glucose	.15
Pectose	3.98
Digestible Fibre	2.08
Woody Fibre	2.08
Mineral Matter	3.34

The kernels of seeds of Suwari Nut (*Caryocar tomentosum*) have a similar composition.

Cacao: *Theobroma Cacao*: A tree of medium size cultivated formerly by the Dutch in quantity principally on the banks of the river Berbice, bearing large fruits containing seeds—"beans"—from which, when dried and cured, the cacao and chocolate of commerce are made. There are now about 2,000 acres under cultivation in the colony. The composition of the cured bean of two varities is:—

	Forastero Amelonado.	*Forastero Angoleta.*
Moisture	7.2	6.3
Protein	10.7	8.6
Fat	40.7	52.1
Starch, Sugar, etc.	6.1	7.3
Fibre	17.1	11.9
Ash	4.5	3.1
Alkaloids	1.6	1.9
Astringent Matters, Pectin and Organic Matter	12.1	8.8

Carambola: *Averrhoa Carambola*: A tree bearing five-cornered channelled fruits, 3 to 4 inches long, of a pleasant acid taste, used in making preserves.

Cashew: *Anacardium occidentale*: A tall shrub or tree bearing fruits consisting of a "seed" (the true fruit) at the top and a fleshy portion below. The fleshy portion is eaten fresh. The nuts, when cooked, have an excellent flavour,

Cherimoya: *Anona Cherimolia*: A small tree bearing heart-shaped sub-acid fruits of good flavour. Occurring only in gardens in the colony.

Christmas Tree: *Pithecolobium dulce*: A medium-sized tree of Mexican origin, bearing pods which contain a white, edible pulp. It occurs in gardens in the colony.

Chili Plum: *Spondias purpurea*: A medium-sized tree, native of Jamaica, bearing yellow fruits, one inch long, of pleasant flavour.

Cinnamon: *Laurus Cinnamomum*: A tree introduced from the East Indies but not grown in the colony to any appre. ciable extent. The bark constitutes the cinnamon of commerce.

Citron: *Citrus medica*: A small-sized tree bearing oblong fruits of varying size, the thick rind of which is candied.

Clove: *Caryophyllus aromaticus*: Introduced from the East Indies. The flower bud picked just before it is ready to open and dried in the sun constitutes the clove of commerce

Coconut: *Cocos nucifera*: A tall palm bearing large, rounded fruits of which the kernel, known as "meat," is either eaten raw or exported when dry as copra. From this oil, vegetable butter, etc., are made. The kernel is sometimes converted into meal after most of the oil has been expressed. There are 20,000 acres under cultivation in the colony. Mature trees yield 50 to 100 fruits on the average; and about 5,000 fruits are required to produce a ton of copra. The immature fruits contain a liquid which is a pleasant beverage. The composition of meat, copra and meal is:—

	Meat.	*Copra.*	*Meal.*
Moisture	39.8	3.4	11.4
Protein	3.4	5.4	19.5
Fat	46.1	73.7	15.7
Starch; Sugar, etc. ..	8.1	13.3	20.2
Fibre	1.9	3.0	27.5
Ash	.7	1.2	5.7
N.R.	36.3	36.6	3.1
F.R.	.2	.2	1.3

	Meat.	Copra.	Meal.
F.U.	132.4	211.2	108.3
R.C.	476	762	309

Coffee: see Arabian Coffee, Liberian Coffee.

Cokerite: *Maximilliana regia*: A large palm bearing clumps of numerous ovoid fruits of which the pericarp is eaten.

Custard Apple: *Anona reticulata*: A small, or medium-sized tree bearing rounded fruits about four inches in diameter, containing a yellowish-white pulp.

Date Palm: *Phoenix dactylifera*: Native of Egypt. A few plants occur in the colony. The fruits form a staple article of diet in its native home. Although the palm fruits in some of the West Indian Islands, it rarely fruits in British Guiana.

Dunks: *Zizyphus jujuba*: Native of India and China. A tree whose fruits, of the size of a large cherry, are borne on the branches at the bases of the leaves. The edible portion of the fruit is mealy and of acid flavour.

Fat Pork: *Chrysobalanus Icaco*: A large shrub bearing small rounded fruits of mealy consistency.

Forbidden Fruit: see Grape Fruit.

Geneps or Cheneps: *Melicocca bijuga*: A tree native of tropical America, bearing small green fruit, one inch long. The pulp is acidulous containing malic acid. A decoction of the bark of the tree is astringent and useful in cases of dysentery.

Ginger: *Zingiber officinale*: A perennial, member of the banana family, low growing, producing numerous rhizomes which when cured, constitute the ginger of commerce. A crop can be obtained, in 18 months, of about 4 tons of tubers per acre. Two varieties occur—the Chinese or common, and the Jamaica. Loose friable soil is required for their successful cultivation.

Golden Apple: *Spondias dulce*: A tall tree bearing sub acid yellow, rounded or oblong fruits, about two inches in diameter.

Governor's Plum: see Sidium.

Granadilla: *Passiflora quadrangularis*: A climber with square stems bearing large fruit about six inches long, and four inches or more in diameter, the pulp of which resembles the Simitoo.

Grape—Seaside: *Coccoloba urifera*: A tree growing in its native habitat on the seashore, bearing large numbers of small reddish-purple berries of good flavour.

Grape Fruit or "Forbidden Fruit": *Citrus decumana* var. *Paradisi*. A tree resembling the Shaddock, bearing smaller, smooth, rounded fruits whose pulp possesses an excellent flavour.

Grape Vine: *Vitis vinifera*: A vine bearing clusters of rounded, green or purple fruits which are either eaten fresh or employed in making wines, etc. For its successful cultivation good, rich, light soil is needed. The plant needs careful attention in regard to pruning and cleaning.

Guava: *Psidium guyava*: A loose, spreading tree of small to medium size, bearing green or yellow fruits usually the size of a duck's egg; used principally in the making of preserves.

Flesh	85%
Skin	12%
Seeds	3%

Flesh contains 4.2% sugars.

Guinea Pepper: *Amomum Grana-paradisi*. A herbaceous ginger-like plant whose seeds, when freed from the husk, form a useful spice.

Hog Plum: *Spondias lutea*: A tall tree bearing yellow sub-acid fruits of pleasant flavour.

Jak Fruit: *Artocarpus integrifolia*: A tree introduced from the Pacific Islands, bearing on the stem and lower parts of the branches, large, rough fruits, sometimes more than 20 inches long, containing seeds which resemble and are employed in a similar manner to the Bread Nut.

Jamoon: *Eugenia paniculata*: A quick-growing tree, introduced from the East, bearing round-oblong fruits of the size of a marble. The fruits are eaten fresh and are also employed in making a beverage.

Java Plum: *Syzygium jambolanum*: A large spreading tree, native of the East Indies, bearing large numbers of small purple fruits which are astringent and are used in making a preserve.

Kola: *Kola acuminata*: A medium sized tree whose seeds are used as a condiment. The tree was formerly culitvated in fair quantity on the lower reaches of the rivers.

Lakoocha: *Artocarpus Lakoocha*: A tree resembling somewhat in growth the Jak fruit, bearing on its branches reddish-yellow fruits whose surface is covered with small knobs. The fruits are of pleasant, sub-acid flavour.

Lemon: *Citrus Limonum*: Similar to the Citron, but bearing smaller fruits which are useful in the preparation of beverages, dishes, etc.

Liberian Coffee: *Coffea liberica*: When allowed to grow unchecked, this plant forms a tree of medium size, bearing rounded fruits whose seeds when cured constitute one of the common kinds of commercial coffee. The lower cost of cultivation, higher yield and cheaper picking and handling of the fruit render it more suitable for cultivation in British Guiana than the Arabian or Creole coffee. The area under cultivation in Liberian Coffee in the colony is being extended There are now 4,600 acres under cultivation in coffee in the colony. The plant commences to bear in 3 to 4 years and when mature gives a return of 7 to 20 cwt. of dried coffee per acre. The value of coffee depends on its alkaloid content. Like tea, when taken in large quantities it may injuriously affect the nerves and stomach. The alkaloids are not present in the fresh seed as such, but are produced by the breaking down of more complex bodies.

Lime: *Citrus medica* var. *acida*: A tree resembling in habit the lemon, bearing small rounded acid fruits from which "lime juice," is obtained. The juice is extensively

used for cooking, flavouring and drinking. There are 1,000 acres under cultivation in the colony in lime trees. The tree takes 8 years to reach maturity, but produces a crop in 3 to 4 years.

Litchi: *Nephelium Litchi*: A tree, native of China, bearing bunches of small fruits of excellent flavour. The tree is but little seen in the colony.

Locust: *Hymenoea Courbaril*: A tall tree, native of this colony, bearing pods which are filled with an edible pulp of pleasant flavour.

Loquat: *Eriobotrya japonica*: A tree, native of Japan, bearing small yellow sub-acid fruits, occuring only in Botanical Gardens.

Love Apple: see Tomato.

Malacca Apple: *Eugenia malaccensis*: A tree introduced from the East Indies, bearing pear-shaped fruits, used principally in making preserves.

Mammee Apple: *Mammea americana*: A native tree bearing large, rounded, brown fruits useful in making jams.

Mango: *Mangifera indica*: A tree of medium size, native of India, largely grown in the colony for its edible fruits. Great improvement in the quality of the fruit has been made from time to time by grafting. Many varieties occur The composition of the fruit is as follows:—

Flesh ..	.. 67—75%	of the whole fruit
Stone ..	.. 22—30%	

The flesh contains 5.5 to 11.5% of sugars, according to the variety.

Melon—Musk: *Cucumis Melo* var. *moschata*: A creeper resembling the cucumber, bearing fruit like the European melon.

Water: *Cucumis citrullus*: Resembling the above

Nutmeg Tree:. *Myristica fragrans*: A tree, native of the East Indies, bearing yellow fruits the size of an egg. The

aril present in the form of a network covering the seed, is the Mace of commerce; the seed is the Nutmeg. The plant is cultivated on the lower banks of the rivers. The yields obtained, however, do not equal those of the plant grown at higher altitudes in the West Indian Islands.

Orange:—Sweet: *Citrus Aurantium*: A tree resembling the lemon, whose fruits vary a good deal in the thickness of the rind and quality of the pulp. The tree is cultivated fairly extensively on the lower banks of the rivers.

Seville: *Citrus vulgaris*: A tree resembling the above, bearing large fruits with a rough rind, used in the preparation of marmalade.

Tangerine: *Citrus nobilis*: Resembles the above in habit, but bears a smaller fruit of excellent flavour.

It usually takes from five to seven years after planting for these trees to commence to bear fruit, although in some cases a small crop may be obtained sooner.

Parapee or Peach Palm: *Guilielma speciosa*: A native palm growing from 60 to 80 ft. high with its stem armed with rings of spines. The fruits, which are scarlet and orange in colour, are borne in large, drooping bunches, and may attain the size of an apricot. The fleshy outer portion of the fruit is rich in starch. It is eaten usually boiled or roasted. A beverage is also prepared by fermenting it. A meal obtained from the fruit is made into cakes. The composition of the flesh is:—

Water	47.93
Oil, Fats, etc.	5.30
Albuminoids	4.06
Sucrose	2.43
Glucose	1.22
Starch	19.50
Gums, Pectose, etc.	4.43
Fibre	13.77
Ash	1.36

Papaw: *Carica Papaya*: A tree, native of tropical South America, seldom exceeding twenty feet, whose stem is com-

posed of soft wood, bearing rounded or oblong orange-yellow fruits of various sizes and excellent flavour. The tree grows rapidly and is cultivated in the colony in fair quantity.

Flesh	65%
Rind	10%
Seeds	25%

Flesh contains 5.6% sugars.

Peach or Mabola: *Diospyrus discolor*: A tree of medium size with dark green leaves, bearing rounded fruits the size of a large apple, velvety with cream-coloured flesh. Cultivated in the colony to a small extent. A native of the East.

Pineapple: *Ananassa sativa*: A biennial, with thin leaves of fibrous texture, bearing numerous short spines. The fruit produced at the end of the short stem, takes the form of a cone surmounted by a crown of small leaves. It possesses an excellent flavour and contains a highly digestive enzyme, capable of digesting 1,000 times its weight of protein in a few hours, hence its great value as a digestive. The fruit contains 85.8% water, 11.5% sugars, .4% ash, 1.5% fibre. The range of variation in the kinds of sugars is, fruit sugar. 1.7 to 9.7%; cane sugar, 3 to 10.5%.

Pimento: see Allspice.

Plantain: *Musa paradisiaca*: A plant with a herbaceous stem resembling somewhat closely the banana. The fruits, which are borne on a spike, are 9 to 10 inches long and about 1½ inches in diameter. They are used in the green state and also when ripe. They constitute a staple article of diet of the inhabitants of the colony. Meal and starch are also made from the fruits. The compositions of the unripe and ripe fruits, and of plantain flour and starch, are:—

	Unripe.	*Ripe.*	*Flour.*	*Starch.*
Moisture	62.8	75.0	11.8	14.9
Protein	1.6	1.3	3.7	.2
Fat	.4	.3	1.0	.4
Starch, Sugar, etc. ..	34.0	18.1	80.7	84.2
Fibre	.4	4.7	.9	.1
Ash	.8	.6	1.9	.2

	Unripe.	Ripe.	Flour.	Starch.
N.R.	22.2	14.4	22.2	425.0
F.R.	85.0	60.3	80.7	210.5
F.U.	39.	22.0	92.5	85.5
R.C.	150	82.3	355	350

Plum Rose: *Eugenia vulgaris*: A tree, native of the East, naturalised throughout the West Indies, bearing pear-shaped, greenish fruits, 1½ inches in diameter, of firm texture and somewhat sickly flavour.

Pomegranate: *Punica granatum*: A small tree, said to be native of Southern Europe, bearing fruits the size of a large apple, containing numerous seeds, each surrounded by a small quantity of fleshy pulp.

Saman: *Pithecolobium Saman*: A quick-growing, expansive tree, native of the East, bearing pods which have the following composition:—

Moisture	63.0
Protein	3.3
Fat	.4
Starch, Sugar, etc.	30.9
Fibre	1.5
Ash	.9
N.R.	9.7
F.R.	75.2
F.U.	40.
R.C.	144

Sapodilla: *Achras Sapota*: A tree, cultivated in many parts of the Tropics, bearing fruits of a brown colour which vary in size with different varieties. The fruits possess a delicate flavour and rank among the best in the Tropics.

Sea Grape: see Grape.

Seville Orange: see Orange.

Shaddock: *Citrus decumana*: A tree belonging to the lemon, "Forbidden Fruit," and Citron class, bearing large fruits with a thick rind. The pulp, of sub-acid flavour, is eaten. The rind is used in making a preserve.

Sidium: *Flacourtia Ramonthii*: A tree producing large quantities of fruit of the size of a large cherry, of a purplish black colour with firm flesh, eaten when ripe or used in making a preserve. Grown in the colony in fair quantity.

Simitoo: *Passiflora laurifolia*: A creeper with variegated flowers bearing rounded yellow fruits whose pulp possesses a pleasant flavour.

Soursop: *Anona muricata*: A small tree, resembling the Custard Apple, bearing large fruits whose pulp possesses a pleasant sub-acid flavour.

Sorrel: *Hibiscus Sabdariffa*: A coarse herb resembling the Okra. The fleshy persistent calyx of the fruit, after fermentation with water, yields a beverage.

Star Apple: *Chrysophyllum Cainito*: A medium-sized tree with ornamental foliage, native of America, bearing rounded green or deep purple fruits from 2 to 4 inches in diameter. The pulp of the fruit is edible.

Sugar Apple: *Anona squamosa*: A tree resembling the Custard Apple and Soursop, bearing green or yellowish green rounded fruits about three inches in diameter, containing a whitish pulp of delicate flavour.

Surinam Cherry: *Eugenia Michelii*: A small tree bearing rounded fruits the size of a large cherry, marked with vertical furrows: of good flavour when ripe.

Suwari Nut: *Caryocar tomentosum*: A large forest tree bearing large fruits each of which contains two, three or four seeds, whose kernels rank among the best of edible nuts. The composition of the kernels is similar to the Brazil Nut. We have, however, found Suwari Nuts on anlysis to be more oleaginous than the Brazil Nut.

Tamarind: *Tamarindus indica*: A tree of medium to large size, said to be native of Tropical Asia and Africa, bearing a pod with acid pulp which makes an excellent preserve and yields a syrup from which a pleasant cooling beverage is made. Grown in towns and villages.

Tangarine: see Orange.

Tonka Bean: *Dipteryx odorata*: A large tree, native of the colony which yields the fragrant seed known as Tonka or Tonquin, used for scenting snuff. An extract is obtained from the useed, which is employed in perfumery. The pulverised seed is used in making sachets, and is also employed in flavouring appetisers or "bitters." The plant grows readily from seed. A tree will yield about 20 to 30 gallons of seeds. The odour of the seed resembles that of new-mown hay, and is due to the presence of coumarine.

Tooroo: *Oenocarpus Batawa*: A tall native palm, bearing bunches of small chocolate-coloured fruits. The fleshy outer portion of the fruit is used in making a beverage resembling chocolate.

Vanilla: *Vanilla planifolia*: A climbing orchid bearing thin pods which are extensively used for flavouring purposes. This and other species are native of the forests of the colony. The pods are used by the native Indians, but there is no recognised industry in the colony.

The following table prepared by us in conjunction with Mr. Ward for the Government in August, 1914 shows the principal kinds of vegetable food-stuffs which are locally grown, the time usually taken from sowing or planting to reaping, and the average crops which they may be expected to yield per acre under the conditions prevalent on the front lands of the colony. The yields given in the table are for crops grown *per se*; when they are raised in mixed cultivation their yields will be almost proportionate to the area each kind occupies, although in some cases the yields per actual area occupied may be somewhat greater in mixed cultivation than where crops are grown separately. On the other hand it is certain that the yields of many others will be more than proportionately reduced.

	Months.	Yields per Acre.
Sweet Potatos ...	4— 5 ...	2 to 4 tons
Cassava... ...	9—11 ...	4 to 8 tons
Arrowroot ...	9—11 ...	7 to 14 cwt. starch
Indian Corn or Maize	4 ...	16 to 25 bushels
Guinea Corn ...	3— 5 ...	20 to 50 bushels
Yams	9—11 ...	$1\frac{1}{2}$ to 3 tons
Tannias ..	9—12 ..	$\frac{1}{2}$ to 2 tons
Eddoes... ...	10 ..	$1\frac{1}{2}$ to 2 tons
Ground Nuts ...	4— 5 ...	$\frac{1}{2}$ to $\frac{3}{4}$ ton
Various beans ...	3— 6 ...	Not known
Pea trees ...	11—12 ...	3 to 4 cwt.
Papaws ...	10—12 ...	50 lbs. per tree
Pumpkins, etc. ...	6 ...	2 cwt. per vine may be obtained under favourable conditions.

In 1903 after the occurrence of a severe hurricane in Jamaica the Hon H. H. Cousins, M.A., F.C.S., Director of Agriculture in that colony, compiled the following very instructive table, showing the proportion of nitrogenous, flesh-forming or proteid content in lbs. per ton of important varieties of foodstuffs, the fuel value in British Units, together with statements of average labourers' requirements of each sort of food in pounds per diem, firstly to conserve his bodily condition by meeting its nitrogenous requirements, and secondly to meet its requirements in fats and carbohydrates when engaged in heavy labour. The well balanced nature of such tropical foodstuffs as sweet potatos, rice and corn meal, where the quantities required for conserving the bodily condition and for meeting working requirements are approxmately similar, is very clearly indicated; whilst the lack of balance in dried banana, breadfruit, mango pulp, coconuts and molasses, each of which supplies an excess of carbohydrates, and in beans, peas, salt fish, and fresh fish, where the proteid content is very high in relation to the fats and carbohydrates, is noticeable. The advisability of using relatively small proportions of these foods containing a high proportion of protein in conjunction with larger quantities of those rich in fats and carbohydrates, is clearly indicated by the figures given by Mr. Cousins.

	Flesh Formers: lbs. per ton.	*Fuel Value: units per lb.*	*Labourers' Food Requirements: lbs. per diem.*	
			To conserve bodily condition.	*To meet working require-ments.*
Sweet Potato	42	440	9	$7\frac{3}{4}$
Irish Potato	36	295	10	$12\frac{1}{2}$
Dried Banana	32	1,456	12	$2\frac{1}{3}$
Bread Fruit	47	823	8	4
Mango Pulp, No. 11	8	318	47	$10\frac{3}{4}$
Coconut	58	2,500	$6\frac{1}{2}$	$1\frac{1}{3}$
Bakers' Bread	180	1,30[illegible]	2	$2\frac{3}{8}$
Rice	160	1,620	$2\frac{1}{3}$	2
Cornmeal	184	1,645	2	2
Beans (shelled)	142	540	$2\frac{1}{2}$	$6\frac{1}{4}$
Peas (dried)	428	1,505	14 ozs.	$2\frac{1}{4}$
Salt Fish	320	325	$1\frac{1}{4}$	$10\frac{1}{2}$
Fish, fresh	200	370	$1\frac{7}{8}$	$9\frac{1}{4}$
Pork, fresh	260	1,300	$1\frac{1}{8}$	$2\frac{3}{8}$
Molasses	nil	1,225	useless	$2\frac{3}{4}$
Cow's Milk	66	310	$\frac{1}{2}$ gal	1 gal.

While we have been dealing in the above with foodstuffs from the aspect of their compositions, the importance of vitamines cannot be overlooked. These bodies are present in such foodstuffs as brown rice, maize, guinea corn, wheat, sweet potatos, bananas, and other fresh fruits, butter and milk. Hot-air-dried foodstuffs such as cassava and banana meals and flours as well as white and polished rice are deficient in vitamines; the almost complete absence of vitamines from purely starchy foods, and from both animal and vegetable fats when separated in a state of purity from the other constituents of the products in which they are contained, or, as in the case of ghee, when prepared at unduly high temperatures, is of importance. At the present it is not feasible to determine the relative proportions of these bodies by chemical analysis; but consideration must be given to their presence or absence in the drawing-up of any scheme for nutrition in tropical as well as in temperate climates.

War Cookery.

The Preparation and Cooking of Locally Grown Vegetable Foodstuffs.

By Mrs. J. F. Waby.

There is a very old saying which tells us that "It takes a very good cook to boil a potato, as though easy to boil it's easy to spoil." The same may be said of all vegetables; they are not difficult to cook, but they are very easily spoiled. If not perhaps actually spoiled, they are not what they ought to be either in appearance, taste or adaptability. In all books on Domestic Economy, Cookery, etc., great emphasis is laid on the need of great care in cooking and serving vegetables.

British Guiana has been described by an old resident as "a land of sodden vegetables," and not without reason; yet the blame does not lie with the vegetables, but with the lack of care and attention given to their preparation and cooking. Sometimes perhaps, it is due to lack of knowledge, particularly in the case of new-comers to the colony. The

announcement of "No potatoes to-day" so often seen in this war time in shops overseas should cause no alarm in British Guiana; we have so many good and nourishing substitutes Few people who have eaten yams properly cooked, carefully crushed and seasoned, or have enjoyed cassava, boiled, roasted or fried, would regret potatoes as they often appear on our tables. Old bush travellers have often said that a roast plantain or a bit of roast cassava is far better with morning tea or coffee than bread or crackers.

RULES TO BE OBSERVED.

The most important rules to be observed in cooking vegetables are: they must be put into *boiling* salted water and kept at boiling point; taken up as soon as done, and *all* the water drained from them. If they are to be kept hot, a clean cloth should be folded over them to absorb the steam; if left in the water even a few minutes after they are done

they will become sodden and tasteless. The only exceptions to the rule of boiling water are dried vegetables.

GREEN VEGETABLES.

In this as in all Tropical lands, green vegetables soon lose their crispness and freshness. They should—if possible as soon as gathered or purchased—be covered with a cloth wrung out of clean cold water. In the case of vegetables with roots or stalks—such as cabbage, lettuce and the various kinds of calalu—the roots or stalks should be put in water and the leaves covered with a wet cloth: green shalots, parsley and other seasonings keep fresh a long time if kept in a damp cloth and put in as cool a place as possible.

SPECIFIC INSTRUCTIONS.

French beans and green vegetables of all kinds, if limp and flabby, should be laid in a bowl of salted water for half-an-hour before cutting. Of all local green vegetables the various kinds of calalu may be considered the best—"Indian Kale" being quite as good as spinach if cooked in the same way.

Indian Kale.—Strip the leaves from the stalks: if the mid-rib of the leaf is tough, cut it out, wash in one or two waters to remove dust, etc., put into a saucepan with as little water as possible (just enough to prevent burning), press down the leaves that all may be cooked alike; and when tender strain and press through a colander. Chop fine, add a little butter and pepper and return to pot to heat again, stirring carefully. Eddoe leaves—*i.e.,* "Water Calalu"—"Climbing Calalu" and "Caterpillar Calalu" may all be cooked in the same way: if served with gravy, the butter may be omitted.

Ochroes—The young pods should be topped and tailed, put into boiling salted water, drained as soon as tender, and a little lime juice and black pepper put over them.

French Beans—locally called "Sinabones"—should be topped, tailed and the strings cut away thinly, or stripped from the sides, cut in strips, put into boiling salted water, and boiled for 20 minutes; *the water must all be poured off*

as soon as they are done or they become sodden and tasteless. "Goa" Beans may be cooked in the same way, but take about 30 minutes. They should be cut into short lengths. They are very like young cabbage in taste and should have a little black pepper added and, if liked, a little lime juice.

"*Sword*" *Beans*, only recently recognised as a valuable food product, are very good used as string beans if the pods are picked young, when about 4 to 5 inches in length. Cooked like French Beans, it is better to cut them into thin strips.

Some of the lately imported Bonavist Beans, notably the "Park Runner" and the broad, flat, white waxen beans are very delicate when cooked like French Beans.

The beans or seeds of the Sword Bean are covered with a tense, white skin, and unless they are used when only half-grown it is better to remove it. Shell the beans and put them into boiling salted water; when done, take them up and slip the beans out of the outer skin (as "Almonds" are blanched), return them to the saucepan and either add a little milk or make a little white sauce if butter is available. They are excellent warmed in milk with black pepper added to taste. They are very mealy and burn if not watched and stirred in the milk.

Nearly all the Bonavist beans are good, shelled and boiled as side dishes, or in soup. The round full-podded white ones are the best; they resemble English green peas in appearance and—if cooked in the same way—in taste. They should be shelled, washed, put into boiling salted water and boiled till tender. A bit of mint boiled with them improves colour and flavour. They take from 20 to 30 minutes to cook.

Butter Beans should be cooked in the same way omitting the mint.

The *Purple Bonavist* is less delicate, but is a very excellent bean and should be used in the same way, though taking more time to soften.

Black-eye Beans when young are also good, but when older serve better for soup.

Pigeon Peas—the local "Green Peas"—are much appre ciated when young and tender. They may, like all the Bona-vists and the "Black-eyes," be used with equally good results as side dishes, cooked with rice, or used in various soups.

The *Boulanger* or "Egg plant" is usually stuffed, but may be used plainly boiled, or after boiling cut in slices and fried. When served stuffed (the large round ones are best, "Black Beauties") they must be split about an inch from the bottom and boiled in salted water. When tender cut them in half. take out the pulp and mix with a little minced meat (ham and beef are best) a little butter or margarine, black pepper and chopped shalots. fill the skins with this, sprinkle with breadcrumbs and bake.

Pumpkins, Squashes, Cucumbers, Chrystophines, the young fruits of the Ninewha vine, and the young fruits of the Papaw tree may all be considered as green vegetables. They may all be prepared and cooked in the same way, *viz*: peeled, cut into pieces, put into boiling salted water, boiled till tender, taken out of the water at once, and served in pieces or mash with a little black pepper and margarine or sauce. When margarine is used for vegetables it must be melted first; it does not dissolve as readily as butter.

An excellent sauce for beans, peas, or any vegetable may be made as follows:—cut a small onion and a tomato in slices, fry till brown with a morsel of fat pork, add some chopped seasoning or any herb preferred, pepper, salt and a little margarine; add required quantity of water, boil together for a few minutes, thicken with a little rice flour or cassava meal. This may be strained if desired, but is good either way to add savouriness to vegetables.

GROUND PROVISIONS.

Of all our ground provisions the yam is the most useful. The varieties of yam "are legion," and the ways of cooking and using it many.

Boiled Yams.—Peel and wash a yam, put it into boiling salted water, boil till tender, take it out as soon as it is done, crush it lightly, or serve cut in slices if large; if small, whole.

Yams vary so much that a definite time cannot be given, but 30 to 40 minutes is the average, unless they are very small.

Roasted yams are excellent. Mrs. R. J. Bovell, of Barbados, gives the following direction for roasting yams: "Lay a yam before the grates of the stove or in the oven, turning it occasionally till cooked, scrape off the outer skin, cut into pieces or mash with butter and serve hot."

Boiled yam cut into chips and fried is very good.

Cold yam may be used in making bakes, fritters, etc., (see "Puddings.")

Boiled "Buck" yam mashed with milk and a little salt, or with a little butter, is good food for young children.

Sweet Potatos.—Mrs. R. J. Bovell says: "Sweet Potatos should be boiled in their 'jackets.' When cooked peel and cut into slices before serving." Cold sweet potatos "may be cut and fried like cold yam."

Roast Sweet Potatos—"Same as for yams."

Broiled Sweet Potatos—"Potatos to be half boiled, the skin removed, put into the oven or before the fire till they are a nice brown colour."

Sweet Cassava is good either roasted or boiled. To roast, lay a stick of cassava in the ashpan, turning it occasionally. When done, scrape off the outer skin, burst it a little to let the steam escape and roll in a clean cloth to keep hot.

Boiled Cassava. Peel the cassava, cut into pieces 4 or 5 inches long; if very thick, split them. Put into boiling salted water, boil till tender (from 10 to 20 minutes, according to size) take up at once, let steam evaporate or it will be sticky and sodden instead of being dry and floury.

Cold cassava sprinkled with salt and pepper and fried is very good.

Any cassava put away for using in bakes, pie-crust, or puddings, should be flaked free of lumps with a fork while hot: it then keeps drier and is more easily worked up.

Eddoes and Tannias are more generally used for thickening soups, but they are good boiled in salted water, mashed while hot, and sprinkled with black pepper.

White Tannia mashed free from lumps and mixed with milk or butter is very good for children.

Plantains have been called "the staple food" of the colony, so general is their use.

Green plantains are usually boiled with salt fish: a slice of pork and one of salt beef is sometimes added, or the pork is melted and the fat used with the plantains.

To make "Foo-Foo" or pounded plantain they are boiled alone without salt. When done thy must be taken out of the water and left to cool. They must be pounded in a wooden mortar with a "foo-foo stick": it is necessary to dip the pestle in water occasionally to prevent sticking. The paste must be smooth and rather soft. With a spoon dipped in cold water remove the "foo-foo" from the mortar, flatten to shape and serve with soup.

Yellow plantains, *i.e.*, ripe, but not soft, are boiled and served as an ordinary vegetable. Taking off the ends and boiling them in their skins, keeps them a better colour. The skins slip off easily.

Fully ripe plantains are cut into slices and fried.

Green plantains, cut into thin slices and dried in the sun, are ground and yield plantain flour, or conquintay flour.

Green Corn. The pods for boiling must be only just full, and not at all hard. Strip the husks off, leaving the inner one. which draw down so that the silk may be removed, then tie the inner husk round the cob, put the prepared cobs in boiling water with plenty of salt, boil till tender, take up and drain, put a little butter on and serve hot.

Or the corn may be removed from the cob with a sharp knife and boiled: when finished it may be served with only a little black pepper, but is better with a sauce or with

butter. The cobs for roasting should be stripped. If the fire is strong they may be roasted in the ashpit, but a clear coal fire is best, turning them that they may be done all round.

Bread-fruit is a valuable food product, but in itself is rather insipid. If boiled in soup, stew, or with other vegetables it must be peeled and the core removed. It takes very little time to become soft When boiled as a plain, table vegetable breadfruit should not be peeled, but cut into quarters and put into boiling, well-salted water, boiled 15 or 20 minutes, according to size, taken up at once, laid on the "peel" side till the steam has gone, then peeled, the core removed, cut into slices or mashed with black pepper. Boiled in this way and put away till cold, then peeled, cored and cut into rather thick slices, sprinkled with pepper and fried in "crisco," lard or dripping, is the most tasty way of using breadfruit.

Breadfruit intended for bakes, etc., should not be crushed until wanted for use.

VEGETABLE SOUP.

Although our local vegetables are at their best when cooked in soups—that is, none of the good in them is wasted—they do require the addition of fat in some form; strictly "vegetarian," *they must be enriched with milk or butter.* For ordinary use it is better to use a little salt or fresh meat.

The most suitable vegetables for soups are Tannias, Eddoes, Cassava, Pumpkins, Peas, Beans, Ochroes and Calalu. Each and all are good, but they may be improved and seasoned with green "seasoning," a bunch of which contains a bit of green celery leaf, a spray of marjoram, a leaf of coarse thyme and a few green 'shalots, or onion, garlic, tomatoes, (red pepper if liked), and black pepper and salt. To make them really nutritious, a little beef essence or good meat stock is necessary. But in any time of stress, especially now in "war time," we cannot always get what we like, and must perforce like what we can get. The economical value of soup as an article of food is that meat rejected from joints, chops, etc., locally called "soup meat," is cheaper. Bones, (fresh or already cooked), scraps of cooked

neat, salt or fresh fish (free from bones) may all be used as a basis. Bones that have been roasted or fried in cooking, give soup a good colour and flavour.

Whether the meat available be much or little, if it is to be eaten with the soup it should be cut into pieces, put into cold water without salt, brought slowly to boiling point, all scum removed as it rises and boiled till tender, when vegetables and seasoning should be added. When the vegetables are done, they should be taken out, mashed and returned to the soup with salt and black pepper to taste.

When meat and vegetables are to be used separately, the meat must be put into nearly boiling water without salt, brought to boiling point and allowed to boil 2 or 3 minutes till the scum rises. When this is removed the meat must be cooked slowly till tender, when salt may be added. Only sufficient time must be given to the vegetables to cook them without mashing. Onions or any seasoning to remain in the soup should be cut small. A few pieces of green papaw boiled with the meat, help to make it tender, and with pieces of boiled pumpkin, make a nice garnishing for the meat.

When all are done, the meat and vegetables should be taken out and the soup thickened with plantain or cassava flour—a tablespoonful to each pint of soup is a good average. The flour must be mixed smoothly with cold water, poured slowly into the boiling soup and boiled for a few minutes, stirred to prevent burning and salt and black pepper added to taste. Cornmeal may be used for thickening, but is better made into dumplings, boiled separately and dropped into the soup.

Soup made from beans or peas is very nutritious; for weak digestion the peas should be pulped from their skins and returned to the soup, but for general use this is not necessary. If dried peas or beans are used for soup, they must be well soaked in cold water, put into fresh cold water, brought slowly to the boil, and boiled till tender.

All calalus contain a great deal of water, and it is advisable to boil them separately, or allow for the water in them. Ochroes should be sliced. Old time folks say, "soup with

ochroes and calalu in should never be stirred with an iron spoon."

For those who like them a few shrimps, picked and scalded, improve most soups.

White tannias boiled in as little water as possible, mashed in the same water, milk added to make it creamy, with a very little pepper and salt, and a small bit of butter (margarine is not good in this) is a delicate and nutritious soup for young children.

CURRIES.

Curries, if carefully made and served with a wall or border of well boiled rice, are appetizing and economical dishes, as they adapt themselves to any standard of cooking. They may be simple, or elaborate as circumstances permit.

Cold meat of any kind, fish, some vegetables, such as boulangers, cucumbers, and the smaller kinds of squash, make excellent curries. Eggs, boiled hard and cut into slices or quarters, as a dish by themselves or to help out a scarcity of meat, shrimps scalded and picked, salt fish cleaned and boiled, are all good.

Fish should be freed from skin and bone, which may be well boiled, the water strained and used instead of plain water for fish curries, as it is very gelatinous.

Any stock that can be made from meat bones or scraps is much better than plain water and, of course, makes the curry richer.

To make a good Curry:—

Slice 2 or 3 onions, fry them to a good brown, taking care that they do not burn, cut meat or fowl available, fry it with the onions, put all into a stewpan with a clove of garlic, and 1 tablespoonful of curry powder, cover it with water and let it stew gently till tender, mix a full teaspoonful of cassava, rice, sweet potato, or plantain flour (either will answer) with a little milk, a bit of butter, and some salt into a smooth paste and stir gently into the lot, and let all boil together.

A little lime juice is an improvement, but it must not be *boiled*—put it in when all is finished.

A simple way of making curry sauce for anything already cooked is to brown the onions, adding water (or stock) as required, mix 1 tablespoonful of curry powder, a teaspoonful of thickening flour, salt, a little butter, gravy or water, put into the pan with the browned onions and stir well till smooth, add cold meat, etc., and let all cook very slowly till heated through.

"PEPPER POT," *i.e.*, "BUCK POT."

A "Buck pot" with cover is used for this old time dish—which like curries, may be made with the best of everything, or when "needs must," with simpler ingredients.

The basis of "Pepper Pot" is usually fresh fat pork, but it is less rich and much more nutritious when made with cow-heel, shin of beef, or pig's head and trotters. The meat must be cut up and boiled with a slice of uncooked salt-beef. When half done add 3 or 4 tablespoons of good, thick cassareep, 1 dessert spoonful of brown sugar, a few peppers, and salt to taste. It must boil till the meat is quite tender. Pepper-pot must be warmed every day to prevent it turning sour. When adding fresh meat, either cook it till tender separately or remove the already cooked meat until the fresh meat is well done, put back the removed meat and boil again. Cold meat may be added before boiling.

Irish Stew is a very economical dish in which a very little meat, fresh or cooked, will go a long way. If made of fresh meat, "soup meat" is excellent; the meat must be put into cold water without salt, brought to boil, any scum removed, and slowly stewed till nearly done, when the vegetables and seasoning may be put in, with pepper and salt, and all cooked together. If it is necessary to add more water, it should be hot. Cassava, yam, or sweet potatoes are all good in "Irish Stew."

If Irish Stew be made from cold meat, the vegetables should be boiled in only sufficient water to make the stew thick and good—not watery. The seasoning must boil with them and the meat be added when the vegetables are nearly done.

Pepper and salt to taste. Keep *stewing—not* **boiling—or** the meat will harden.

WAR TIME MEAT PIE.

Yam, cassava, sweet potatos, eddoes or tannias, may be used for the "crust" of this pie. The boiled and crushed vegetable must be mixed with a little margarine or dripping; pepper and salt; a deep pie dish should be lined thickly with it, and the meat stewed with onions or shalots and a bit of fat pork (a goodly supply of gravy being made with it). A layer of meat is put in, then another of vegetables, more meat and all the gravy; and a thick cover of vegetable added and a bit or two of butter or dripping. Bake a light brown.

An excellent "crust" for meat pie may be made of boiled and crushed cassava and a little margarine or other fat and a few spoonfuls of cassava flour. Sift half a teaspoonful of baking powder and a little salt with the cassava flour, add to the cassava and knead all together till stiff enough to roll. If the cassava is dry a little water may be necessary, but must be sparingly used, or the paste will be sticky. Sprinkle flour on a board and roll the paste to the thickness desired. The pie dish may be lined with it, or if the meat is sufficient to fill the dish, only the cover need be made of the paste. Make a hole in the centre of the pie to let the steam escape. Bake a good brown.

Fish—free from bone and nicely seasoned—may be used for either of these pies.

RISSOLES, PLAIN AND SAVOURY.

Plain rissoles may be made from yam, sweet potato, or cassava.

Boil and mash the vegetable; add pepper and salt and parsley chopped (if liked); shape into rissoles; dip in beaten egg; roll in bread crumbs, and fry.

Rissoles are the most tasty, though not the most economical way of using scraps of cold meat or fish.

Mince or chop finely any cold meat or fish with seasoning, pepper and salt, mix with vegetables prepared as for plain

rissoles, moisten with a little milk, or a beaten egg, roll in bread crumbs or cassava flour, and fry.

Meat or fish cakes are made in the same way, but shaped into cakes and plainly fried.

CEREALS.

Rice, well boiled, is the basis of very many savory and sweet dishes, besides being in itself one of the best of our locally grown foodstuffs. In cooking, care must be taken that it is thoroughly boiled, a point sometimes overlooked in the desire to have it "grainy." Nothing is more indigestible than half-cooked rice.

A very up-to-date cookery book gives the following recipe and calls it

"*A perfect way of cooking Rice*:—

"Put one cup of thoroughly washed rice into 5 cups of boiling water, cook from 15 to 20 minutes in a covered saucepan then set the saucepan *uncovered* in a warm place till all the water is evaporated. Rice should not be stirred, only shaken."

The most satisfactory way of cooking rice as a breakfast dish is as the well known "rice and peas." For this almost any kind of peas or beans may be used, green or dried: the dried variety must, of course, be well soaked previously.

To a pint of peas, allow a pint of well washed rice, a pinch of soda if the peas are hard, and only water enough to cook the rice When the peas are soft, add rice, an onion chopped, and a bit of salt pork and beef cut up. Salt fish may be used, or scalded and picked shrimps. Boil till all is well done and the rice rather dry.

Cold boiled rice may be used for puddings, rissoles, thickening soups, or in sweetened and flavoured milk as "rice milk."

Rice cooked with a young chicken and a small piece of fat pork, an onion or green shalots, makes a very dainty

dish. Or an old fowl may be well stewed with seasoning in plenty of gravy and rice enough to thicken the gravy used.

Rice Kedgeree is made by boiling and seasoning rice, adding fish already cooked, boned and skinned, or a tin of salmon, and pepper and salt to taste. A little milk is necessary if dry fish be used, but the oil of the salmon is sufficient.

Rice flour is invaluable in nursery or sickroom, as well as in making many dainty sweet dishes for table; used in the proportion of half and half it mixes well with wheat flour in pastry, etc. (see "Cakes.")

For blanc-mange and custards, rice-flour should supercede all imported "corn starch," "custard powder," etc. (See "Puddings.")

The "Indian corn meal" or maize flour should be far more generally used than it is, being perhaps, the most satisfying of all meals or flours, excepting oatmeal, for which it is an excellent substitute.

"The nutritive qualities of maize are considerable." As "stirabout" or "porridge" it is plainly boiled, in salted water, till thick, and eaten with milk, sugar, or molasses.

Cold boiled maize can be cut into slices and fried. It makes good cookies. (See "Cakes.")

The flour of guinea corn or millet is used in the same way: it is finer and less rough in taste.

Banana flour, locally called "Conquintay" flour, makes delicious gruel (*i.e.*, "pap") and pudding: and is excellent used for dumplings in soup or with stews.

Plantain flour is a good substitute for wheat flour, for thickening gravies and soups or for making thick sauces for haricot beans, or indeed any kind of beans.

STARCHES.

The best and most well-known of these is arrow-root.

Arrowroot is a pure starch, invaluable in the sick room, and for infants if blended with milk; or in convalescence with wine or meat essence. It is used for blanc-mange, custards, and biscuits. (See "Cakes.")

Cassava starch has many uses. Though not quite as delicate as arrow-root, it may be used in the same way. Mixed with equal proportions of wheat flour it is excellent in cakes, etc.

Sweet potato flour is very good used for thickening soups, stews, gravies or sauces. It can also be used like rice flour in cakes, etc.

For making arrow-root, cassava starch, or "tous-les-mois" into nourishment for the sick, 1 tablespoonful should be mixed smoothly with part of a pint of milk (flavoured or not as desired); the rest of the milk boiled and poured slowly over the mixed starch, stirred and returned to the saucepan; boiled and stirred 5 or 6 minutes and sweetened to taste.

Banana and plantain flour or starch can be prepared in the same way, but should be boiled quite 10 minutes after mixing.

Breadfruit, sliced, dried and pounded makes a very fine flour, which may be used for custards, puddings, gruel, or for thickening sauces.

PASTRY.

"War time" meat pies have already been dealt with.

Pastry for an ordinary Meat Pie:—If equal parts of rice flour and wheat flour are used the pastry, though light, is not flaky. The addition of baking powder—1 teaspoonful to 1lb. of mixed flour—makes it lighter, but it dries more quickly. A good short crust for either meat pies or fruit tarts may be made as follows:—Half a pound each of wheat and rice flour (or cassava flour), 1 salt-spoonful salt: sift together lightly; ½lb. lard, "crisco," or "cottolene" (weight for weight crisco is best): rub the crisco into the flour with the fingers as lightly as possible, make a well in the centre

and pour in nearly ½ pint of water: mix all together and roll out on a thinly floured board, fold over and roll again. If time allows it is best to roll part of the crisco (or lard) in first. Rub the pastry and put away for half an hour; roll again and put on bits of crisco, sifting a little flour over. This may be done 3 or 4 times, the pastry being kept in a cool place in the intervals of rolling.

A good crust for Meat or Fish Pie:—Take boiled cassava, finely mashed, wheat flour, a little lard or dripping and milk Mix the flour and mashed cassava together with a little salt, rub in the lard, mix with the milk, roll out and line the edges of the pie dish, fill the dish with meat or fish, cover with the crust, and bake.

PUDDINGS.

Rice Pudding: One cup boiled rice, 1 egg, ½ pint milk, a bit of cinnamon or lime peel, sugar to taste. Put the flavouring into the milk to soak a little while before using Beat egg and milk together, add sugar, pour over the rice and bake.

Cold boiled cassava, nicely flaked or crushed may be used in the same way: so may cold sweet potatos, but great care must be taken to avoid lumps.

Breadfruit pudding is delicious, but requires more flavouring, for which grated nutmeg is best. It is crushed and used in the same way as cassava or sweet potatos. If desired, a few currants may be mixed in either pudding or a layer of jam or jelly may be put in.

Blanc-mange:—1 large tablespoonful of rice or cassava flour (rice is the most delicate), ½ pint of milk, 1 flat tablespoonful of sugar, the thin peel of a lime or a bit of cinnamon. Soak the spice or peel a short time before boiling; mix the rice flour with a little of the milk while cold; boil the rest, and when boiling pour on the mixed flour, slowly stirring it well; put back in the saucepan and boil for 5 or 6 minutes, stirring it to prevent burning; add the sugar, take out the peel or spice and put into a mould or basin to cool. The same mixture with eggs and milk in proportion, poured into a pudding dish and baked, makes

a delightful pudding. A little grated nutmeg and a bit or two of butter is an improvement, but not necessary.

Cold corn meal porridge is good if beaten up with sugar, grated spice and milk, and eggs, if available: or corn meal may be boiled with milk, spice and sugar. Both, if baked slowly, are good and satisfying puddings.

Sweet potato starch and guinea-corn meal make good puddings, or may be used to thicken custards either baked or boiled.

Custard: Take a pint of milk, 3 or 4 eggs, sugar, spice; boil the milk and pour on the eggs, after well beating them, mix one teaspoonful of rice, or other thickening with a little cold milk, stir slowly into the boiling custard, taking care that it does not curdle; if for baking, the oven must not be over hot and the custard must be taken out as soon as coloured.

BAKES.

Bakes are good, made of any of the local flours, and take less fat for frying than pancakes or fritters.

Bakes (cold boiled cassava):—4 table-spoonfuls mashed cassava; sugar and spice to taste, and a spoonful of milk for moistening. A dust of flour helps in shaping them. Fry in boiling dripping or other fat. These bakes are good, satisfying and economical, as they take little fat for frying; if given to children with morning tea instead of bread, or crackers, the results would be better. Of course, if eggs are available they are an improvement. Cold yams, sweet potatoes, or even eddoes can be used, but are not so light as cassava.

FRITTERS.

Light fritters may be made of mashed pumpkins, cassava, yam or bread-fruit: the mashed vegetable must be mixed into a batter with flour, eggs and milk. When well mixed, drop a small cupful at a time into boiling lard, fry them to a light brown on both sides, sift sugar over and serve with a

cut lime. Fritters, though nice, are not cheap, as they absorb so much fat.

"PONE."

"Pone" is made from raw cassava, sweet potatoes, or corn meal. "Cassava Pone."—Grate cassava (raw), add grated coconut, sugar, melted butter, melted lard, a little grated nutmeg, black pepper and powdered cinnamon, some currants (washed and picked), a small red pepper (bruised); well grease a pan; pack the mixture in, and bake.

Add grated pumpkin to "corn-meal pone": other ingredients, the same.

CAKES.

Rock Cakes or Buns may be made of equal parts of wheat and rice or cassava flour. For 24 cakes:—½ lb. wheat flour, ½ lb. rice flour, a small teaspoonful bicarbonate of soda, a pinch of salt, ¼ lb. crisco or margarine, ¼ lb. yellow sugar, a few currants or sultanas or a few drops of essence, 1 egg and nearly ½ pint milk. Sift flour, soda, and salt together, rub in crisco, add sugar and currants, mix well, beat egg and milk together, put in essence (if used), stir all together and make into rock cakes; put on greased tins and bake in a moderate oven about 30 minutes. If the oven is too hot they rise too soon.

This mixture makes an excellent cake put into a tin and *baked till done (one hour at least). Carraway seeds are* good in this, but are apt to burn on the top of buns.

Rice flour may be used with advantage in making sponge-cake, sponge rolls, and light tea cakes. Use wheat and rice flour in equal proportions.

"COOKIES" OR DERBY CAKES.

Half-a-pound of wheat flour, ½ lb. rice flour, 1 teaspoonful of baking powder, ¼ lb. yellow sugar, a *few* currants, ¼ lb. crisco or lard, and 1 egg. Sift flower and baking powder together, rub in crisco, then add sugar and currants, beat the egg—if small, a teaspoonful of milk or paste must be added, very sparingly, for if too moist the paste will not roll out. Mix all together thoroughly, roll out

and cut into cakes, $\frac{1}{4}$ of an inch thick. Bake a very light brown (10 to 15 minutes should cook them nicely.)

Plantain Flour Cookies:—To $\frac{1}{2}$ lb. plantain flour put half a teaspoonful baking powder, sift together, rub in two ozs. crisco, add 2 ozs. sugar, a little ground-ginger or grated nutmeg, add milk or a *small* egg till the mixture is right for rolling: flour the board well, roll, cut into cakes and bake a good brown. A morsel of candied peel, a split raisin, or a muscatel put in the centre improves their appearance only. About 15 minutes should cook them.

Corn-meal Cookies are excellent and keep well. Use the same proportions as for plantain Cookies, but they require slower and longer baking (20 to 25 minutes.)

SCONES.

Scones should be eaten hot if made with corn-meal alone, but if a little wheat flour be added they will be good and satisfying cold. Take half pound of cornmeal, $\frac{1}{4}$ lb. wheat flour, $\frac{1}{2}$ teaspoonful bicarbonate of soda, a little salt, and sour milk to mix. Sift the flour, salt and soda together, mix with the sour milk, roll, shape and bake on hot plate or girdle. If wanted richer, margarine or lard may be added. Cold boiled cassava mashed free from lumps and mixed with a little baking powder, the yolk of an egg and a little salt, makes good scones.

COCONUTS.

The uses of grated coconut are numerous. In cake making and as a filling for open or closed tarts, in giving daintiness to curries, in flavouring and in the form of coconut cream or milk, it is very good.

Coconut Cream:—The nut should be grated. To each cupful of grated nut put one of boiling water, let it stand till cold and strain. This can be used in puddings in place of cow's milk.

Grated coconut mixed with yellow sugar, grated nutmeg or other spice and a few currants, is a good and cheap filling for patties. A little of the mixture added to cassava or

other puddings add to their richness. It is also a nice addition to corn meal or other cookies. For confectionery it takes the form of sugar cakes, coconut drops, ice, candy, etc., and is wholesome and nourishing.

BANANAS.

Bananas are a food in themselves without cooking, but they lend themselves to many very easily made and inexpensive sweet dishes.

As fritters they are simply sliced, dipped in any batter, fried and sugar sprinkled over them when done. If too ripe to slice they may be beaten up in batter.

Banana Compote:—Boil together one cupful of sugar, one cupful of water, a small piece of cinnamon bark, the grated peel of a lime and a teaspoonful of lime juice. When boiling, lay in as many pieces of banana as the pot will hold—the pieces can be cut an inch thick.

Baked Bananas:—Peel and cut off the ends of the bananas, split them, sprinkle with a teaspoonful of sugar and one teaspoonful of lime juice. Bake in a hot oven for 20 minutes.

For Banana Jam and Jelly (see "Jams.")

Bananas sliced thinly and sprinkled with sugar may be layered in boiled cassava or bread-fruit puddings.

JAMS, JELLIES AND PRESERVES.

The following directions for jam and jelly making were written when white sugar was cheaper; they may still be followed; but for war-time cookery yellow sugar, which is less than half the price, must be substituted.

It must be remembered that jam or jelly made with yellow sugar requires *quite 10 minutes longer boiling*, and all scum rising must be carefully taken off.

All fruits used as stews, jams or preserves of any kind, should be boiled till tender with spice or other flavouring and carefully skimmed before the sugar is added. Less sugar

is required and a better result obtained in this way than when, as is frequently done, all are put on together.

(Extract from "The Journal of the Board of Agriculture," January, 1909, Vol. II., No. 3.)

For *Guava Jelly* the fruit must be cut and boiled for 20 to 30 minutes in sufficient water to cover it well, stirred with a wooden or enamelled spoon to loosen the seeds and prevent burning; then carefully strained through a coarse cloth or muslin; left a little while to settle, and then the clear water used in the proportion of 2½ pints to 2 lbs. of sugar.

Let the water boil, then add the sugar and a piece of alum about the size of a small cherry. From the time it starts boiling again it must boil as fast as possible for 20 minutes: the pan must be large, so that its contents will not require constant stirring to prevent boiling over; as every time a cold spoon is put in it receives a check and so requires longer cooking. To make clear, bright jelly very fast boiling is essential. Have a piece of cellular cloth or coarse muslin ready, strain the jelly immediately, put into bottles, fill full, and screw down at once.

Pine-apple Jam:—This requires great care as it burns very easily. The fruit must be chipped or grated, weighed, or measured, boiled in its own juice or, when necessary a little water may be added. Then to every pound or pint allow one pound of granulated sugar and boil quickly, stirring constantly for 30 minutes or even a little longer if it is to be kept long or exported.

Carambola Jam: The fruit must be prepared by cutting off the acute edges, then cutting into pieces about ¾ inch thick; boil 2½ lbs in 1½ pints of water till tender, which will take about 15 minutes; then add 2 lbs. of best granulated sugar and boil for 15 to 20 minutes. The seeds give a delicious noyeau flavour.

The same quantities of fruit, water, and sugar, and the same time for boiling does for *Sorrel Jam*; this is improved by the addition of a few cloves.

Sorrel Jelly. For this the fruit must be boiled to a pulp, strained, and 2 lbs. of sugar with a few cloves added to every 2½ pints of juice. As in guava jelly, it must be strained when finished, and corked or screwed down immediately.

Orange Marmalade. For making this in the tropics, where the fruit is fresh and the rind full of the essential oil, very few of the recipes given in cookery books answer

The fruit should be cut in quarters, the flesh separated and soaked in sufficient water to cover it, the peel in *salt* and water. The peel must be boiled in two or three waters: the first with salt to extract the bitterness. As soon as the water boils it must be poured off. If the peel be boiled more than a minute or two with the salt no after boiling will make it tender. In the last water it must boil till soft enough to rub between finger and thumb. Then cut into thin slices, scraping away the white flesh. Next, well rub the figs of flesh to get all possible juice and gelatinous matter out, and strain; boil 2½ pints of this juice with 2½ lbs. of sugar. When nearly done—in 15 to 20 minutes—add 1½ lbs. of sliced peel, boil together very slowly for 5 or 6 minutes;—if boiled longer the peel will harden. Orange marmalade if properly made, bottled and covered while hot, improves by keeping.

Green Mango Jam. Grate full green mangoes; to every 4 cupfuls of grated fruit put 2 cups of water, a bit of ginger: or cinnamon (ginger gives the best flavour); boil till tender stirring frequently; when soft add 3 cups of yellow sugar, boil till it is quite thick, stirring constantly with a *long* enamel or wooden spoon, as it jumps and splashes badly when nearly done. Allow 10 to 15 minutes to boil the mangoes, 20 to 30 to boil the jam. Note:—*Never* use an iron spoon to stir fruit or jams, it blackens them and spoils the flavour. Mango jam is delicious when carefully made.

A nice way of cooking mangoes for dessert or to eat with bread or pudding, is to cut the mangoes in strips; to every pound of mango put 1½ pints of water and a bit of ginger; boil slowly till tender, stirring carefully so as not to break the strips; when soft add ¾ lbs sugar to each lb, of fruit,

boil slowly again for 30 minutes. When cold it should be pretty to look at, *i.e.*, strips of fruit in jelly—and dainty to eat.

Green Papaws may be used in the same way, but they require the addition of lime juice to give the necessary acidity. Green papaws make a fair substitute for apples, used in tarts or for sauce. For sauce, spice should be omitted.

Mammee Apples are used for jam and jelly—for jam, exactly like green mangoes. Care must be taken to avoid the white pith under the skin, which is very bitter.

Golden Apples are stringy and fibrous and should be boiled till they will pulp through a sieve. Allow 2 cups of pulped fruit to 1½ cups of sugar and use cinnamon or cloves for flavouring. They require constant stirring while boiling.

Cherries, Gooseberries, Hog plums, and *Governor plums*—(commonly called "Sidiums")—are best made into jellies, on account of the tense skins and seeds. Use the same proportions of strained water and sugar as for guava jelly.

Sorrel makes a bright crimson jelly and is a good substitute for red currant jelly which it resembles in appearance and taste. Pick the red calyx from the seeds and steep in water to cover, with a few cloves, for an hour or so; then boil in the same water till mashed; strain through muslin or crash, and allow 2½ pints of strained water to 2 lbs. yellow sugar.

A coarse jam is sometimes made from the red calyx, after being soaked for Sorrel drink.

Sorrel Syrup. Boil and strain the red calyces, add to 2 pints of the strained water a few cloves, and 1 lb. of sugar; boil till it is a thick syrup; bottle while hot. A tablespoonful swizzled in water makes a cooling and healthful drink.

Soursop makes a good opaque jelly. It should be peeled, boiled and strained, left to settle and the clear water used in the proportions of 2½ pints to 2 lbs. sugar.

Bananas, cut, boiled and pulped make a good jam for immediate use; they require the addition of spice and lime juice, and sugar to taste.

Banana jelly, is also good for immediate use, but has no keeping qualities.

There are so many other fruits that are better for jams and jellies, that bananas are rarely used, more particularly as they have so many other uses.

CHUTNEY.

A simple, cheap and good way of making a most appetizing Chutney from green mangoes or green papaws is:—Grate mangoes or papaws and boil in enough water to keep from burning. When cold, measure, and to 2 cups of fruit, put 1 cup dark sugar, 1 cup brown vinegar, 1 or 2 blades of garlic, one or two onions chopped or pounded finely and red peppers to taste, (also pounded): boil over a slow fire till quite thick, stirring with a long spoon or stick, as it splashes like mango jam; put hot into screw-topped or tightly corked bottles and while hot, cover.

Chutney made carefully will keep for months.

There is never a month that some fruit is not available, for jam, jelly or stewed fruit. Many of these fruits are excellent substitutes for imported preserves. Many of them have a distinct flavour and adaptability to the need of residents in tropical climates; and in War time should be largely used on account of their cheapness and freshness, and to avoid the large waste of good nourishing food so often seen and written about by those interested in the welfare of the people of the colony.

WEIGHTS AND MEASURES.

Wheat Flour or Banana Flour.

4 level table-spoons full, weigh 1 oz.
1 cup full weighs ¼ lb.

Cassava Flour.

2 table-spoons full weigh 1 oz.
$1\frac{1}{2}$ cups full weigh $\frac{1}{4}$ lb.

Corn Meal.

3 level cups full weigh 1 lb.

Sugar.

1 heavy table-spoon full weighs 1 oz.
7 spoons full = 1 cup.
2 cups full weigh 1 lb.

Liquid.

2 cups = 1 pint.
16 spoons full = $\frac{1}{2}$ pint.

The Value of Ocular Demonstration.

Those who are inclined to doubt whether museums pla any useful part in war-time should read the account of wha is being done in the Leicester Museum, by means of an Infan Welfare Exhibition to combat the appalling mortality amon infants. This account appears in the Museums Journal fo February, and has been written by Mr. E. E. Lowe, th curator, who is responsible for the scheme and its execution This mortality, which is largely preventable, is brought ou with startling vividness by means of a series of woode columns, that for infants up to twelve months old standin no fewer than 11ft. high, while that for the death-rate be tween the ages from five to twenty is but two and three quarters of an inch high. The food values of human, cow' and condensed milk, the injurious effects of "dummies," of "push-carts," and of certain kinds of clothing, are brough out by means of specimens, models, or diagrams. Model also are used to demonstrate the dangers of contamination b flies. The keenest interest has been displayed in this exhi bition since its installation, especially by the poorer classes for whom it was more especially intended.

"Nature,"—March 2, 1916.

Death of Mr. John Williams.

As we go to press, comes the sad news of the unexpected death of Mr. John Williams, F.I.C., F.C.S., Senior Assistant Analyst of the Department of Science and Agriculture. Time does not allow of an adequate account in this number of the "Journal" of Mr. Williams' long service and many-sided usefulness, but we shall endeavour to do justice to our late colleague in our next issue.

Mr. Beebe at Work.

An ingenious attempt to demonstrate "a Tetrapteryx Stage in the Ancestry of Birds" has just been made by Mr. C. W. Beebe in "Zoologica," Vol. ii., No. 2. The author insists that the precocious and conspicuous development of the femoral tract in the pterylosis of nestling birds points conclusively to a stage in the development of the pro-aves when this tract was formed of large quill-like feathers, which, with similar feathers along the post-axial border of the fore-limb, afforded a parahcute-like mechanism, comparable to the flying-membranes of flying-squirrels, and preceded true flight. The hypothetical restoration of this four-winged stage, which forms the frontispiece to his essay, is curiously like that which appeared in "Knowledge" in 1906, save that this lacked the "femoral wings." Mr. Beebe seeks to justify his hypothesis by an appeal to photographs of the remains of the *Archaeopteryx* in the Berlin Museum. These, however, certainly seem to have been misinterpreted, for the feathers to which he evidently refers are those which invested the tibia No one who has studied the original remains of this fossil would for a moment agree that these afford evidence for this "femoral tract."

—"Nature," Januray 13, 1916.

The Home of the Sugar Cane.

INDIA is thought to be the native home of the sugar-cane. It has been grown there from time immemorial and has been treasured by the natives as a household crop, as dear to the native East Indian as is the pig to his Irish owner in the Emerald Isle.

—"The Tropical Agriculturist": November, 1916.

The Threatened Plague of Locusts.

The sudden appearance of a locust pest in the North West District, on the Essequebo Coast, and at the mouth of Pomeroon River, has recently caused much concern. The following notice prepared by the Government Economic Biologist is here published for general information:

The destructive South American Locust (*Schistocerca paranensis*) has made its appearance in the North West District, Pomeroon, Essequebo Coast, Wakenaam, and possibly other parts of the colony not yet reported.

These locusts appear in flights consisting of winged forms of both sexes. In colour they are rusty brown with darker markings on the wings, the under part of the body is a light yellow.

On the appearance of such swarms in any part of the colony every effort should be made to destroy them so as to prevent their egg laying and consequent wholesale devastation of all crops by their progeny.

Their favourite food-plants appear to be sweet and bitter cassava, Indian corn, tannias, rice and sugar cane. A number of weeds are also eaten by them. The females deposit their eggs in the soil by gradually boring a hole with their tail and as soon as a depth of about 2½ inches is attained some 50 to 60 eggs are deposited. (Several batches are laid by each female.) These eggs are covered with an extremely sticky substance which causes them to adhere together in a mass. The hole is eventually covered by the female.

Egg laying takes place late in the afternoon and only favourable patches of soil are selected; many hundreds of females may be seen laying eggs in such areas.

This renders detection of the eggs an easy matter.

In about three weeks' time the eggs hatch and the young locusts emerge which soon commence to feed.

These insects have no wings and are only able to jump and crawl. They are popularly known as "hoppers" and they

are voracious in the extreme; their powers of destroying vegetation are unparalleled.

They grow rapidly, eventually become mature and are then able to fly. They then leave the district in large swarms and seek fresh areas.

The appearance of such swarms in any district of the colony should at once be notified to the Department of Science and Agriculture.

Methods of control.—These fall naturally under several heads.

Eggs.—The eggs as previously described, should be sought for, dug up, and destroyed. Many thousands of eggs may thus be collected during the course of the day. It is an easy and extremely effective method of control.

Hoppers.—In the early morning and at night the hoppers will be found clustered together in dense masses, they may thus be destroyed by surrounding them with dry foliage soaked in kerosene oil and burnt.

Another excellent method is for a number of men to drive the hoppers into a trench about 2 feet wide and 3 feet deep into the bottom of which kerosene is poured; as soon as the hoppers are driven into the trench the kerosene is lighted and the hoppers thus destroyed.

Arsenate of Lead spray.—The following solution may be sprayed over vegetation in the immediate line of advance of the hoppers and is very efficacious in killing them.

Arsenate of lead paste	4 lbs.
Water	50 gallons.

Arsenite of Soda and Molasses.—This has been found to be the most effective method of killing locusts in other parts of the world.

Arsenite of soda, 1 lb., is dissolved in 4 gallons of water and 2 lbs. of molasses added.

Vegetation in the line of advance and in the vicinity of the swarms of hoppers should be sprayed with this solution.

Paris Green.—This is a powder which, when mixed with slaked lime in the proportion of 1 lb. of Paris Green to 5 lb. of lime may be dusted on the foliage on which the hoppers are feeding.

This powder is best dusted by placing it in a linen bag and beating this with a stick which causes the powder to fly out and settle on the foliage.

The best time to apply all these poisonous mixtures is early in the morning as soon as the foliage has dried somewhat. Extreme care should be taken in handling as they are all highly poisonous.

Selection of Method.—For the small agriculturist collecting the eggs, driving the hoppers into trenches, etc., and the use of Paris Green are the best methods. For those possessing spraying machinery such solutions as described above will be found very effective.

It is absolutely essential that immediate action be taken by everyone to destroy the hoppers as soon as they appear; otherwise the entire cultivated areas of the colony are threatened.

The Locust in Egypt.

UNDER Egyptian conditions the best method of destruction of hoppers is by driving them into small trenches and burying. Contact insecticides are useful, but not to the same extent. The adult locusts should be collected and destroyed; the natives do this willingly for a small payment. Internal poisons and *Coccobacillus acridorum* have proved unsuitable in Egypt. No swarms arrived at maturity and only very little damage was done in general. Cases of appreciable injury were usually due to indifference or negligence on the part of the cultivator or official concerned. Government supervision is absolutely necessary if a locust invasion is to be coped with successfully.

—"The Tropical Agriculturist": November, 1916.

"Kwak" (Farinha) and its Preparation.

In the December (1916) issue of the "West Indië Landbouwkundig Tijdschrift," Mr. A. W. Drost gives some useful information concerning the preparation of "Kwak" or "Farinha de Manioc," as it is called among the Portuguese. Kwak—a corruption of the French term "couac"—is the root of the cassava finely ground and roasted; and in Brazil, French Guiana and the Marowijne district of Dutch Guiana, it forms the food of the great mass of the people. Strange as it may seem, the use of kwak is totally unknown in Surinam itself, where unripe bananas, roasted or boiled, constitute the staple food. Fresh cassava and cassava made into bread or kwak, has, according to Mr. Drost, a much higher food value than bananas. Rice, it is true, is superseding the latter, but until the colony can grow all the rice it needs, our author thinks that more attention should be paid to cassava products and especially to kwak.

APPARATUS NECESSARY.

Kwak can be made either from sweet or from bitter cassava—the latter being the more productive and therefore the variety generally used. The poisonous properties of the root disappear during the roasting. For the actual preparation the following rather formidable list of essentials is given:—

1. Plain knives for scraping the roots;
2. Six or eight dishes or bowls in which to keep the scraped roots under water;
3. A rough grater, or a mill to grind the roots;
4. A wooden bowl in which the cassava pulp may ferment;
5. A press or matapie to squeeze the water from the cassava pulp;
6. A couple of mortars with wooden pestles to break up the pressed pulp finely; and a manarie or sieve to separate out the coarse lumps;
7. A box in which to keep the sifted meal until it is ready to be roasted;

8. A roasting pan;
9. A strong, tightly-closing box in which to keep the kwak.
10. A couple of buckets for carrying water and the scraped cassava roots and pulp.

PREPARATION.

The cassava roots are dug up not more than two days before they are used, and are then scraped with blunt knives—a quicker process than peeling them. They are then "topped and tailed," and care is taken that only clean, healthy roots are used. Discoloured spots are deeply excised. The scraped roots are washed and kept under water, otherwise they lose their whiteness. The scrapings kept under water for 48 hours ferment, and it is usual to mix this fermented root with freshly scraped cassava in the proportion of one part of the former to three of the latter, and then to grind the mixture.

A mill—which may be home-made—is required for the preparation of kwak on a large scale, but for small quantities rough rasps—also home-made—may be used. By mixing the fermented root-scrapings with the fresh, the kwak grinds more easily and acquires the proper yellow colour. Unfermented roots give a product which is too white, and is consequently in no demand.

The excess of water is squeezed out in a matapie in the usual way; the meal is then broken up finely and sifted to remove lumps. The meal must not contain more than 20% of water, if it is to roast properly. The ovens in which the roasting is done are about 4ft. 6ins. long by 3ft. 6ins. wide and 27 ins. high, with an upstanding edge 8ins. high. Such an oven can turn out 22 to 26 lbs. of prepared kwak per hour. The pan must be hot before the pulp is put on it, and this preliminary warming takes about half an hour. Billets of wood are the usual fuel. The roasting is a critical process, and demands constant and careful stirring of the meal to ensure a good result. The kwak is "done" when the larger pieces in the pan crumble between the fingers and no longer "bind."

THE FINANCIAL SIDE.

Good kwak has a light yellow colour, contains no lumps, and has a pleasant odour like that of new bread. Properly packed, it keeps good a long time. To make 175 to 220 lbs. of kwak per day requires the services of three men and three women, *i.e.*, one man to do the roasting, two men to grind the meal, press it and prepare it for roasting, and three women for scraping the cassava roots, washing them, etc. Putting the wages of the first man at 80 cents per day, of the second at 40 cents per day each, and of the three women at 24 cents per day each, and allowing 20 cents for wood, oil, etc., Mr. Drost reckons the cost of making 220 lbs. of kwak at $2.52. With the market price of kwak at 4½ cents per lb. 100 bags of cassava roots—of 176 lbs. each—yielding 30% of kwak, will fetch $240. Putting the price of a bag of the best cassava at $1, and the cost of preparing the kwak from 100 bags at $60.48, the profit works out at about $80.

As a foodstuff, kwak is not quite equal to rice, but it can be produced more cheaply and, where the use of it is general, it fetches a higher price as raw material than rice or maize. An analysis of kwak by Dr. Muller reads:—

Water	9.8%
Fat	0.3
Ash	1.03
Proteins	1.15
Fibre	1.8
Non-nitrogenous substances ..	85.9

Of the non-nitrogenous material, 74% is starch, of which 21% is turned into dextrin and sugar—*i.e.*, carbohydrates soluble in cold water—by the roasting, so that kwak must be reckoned among the very easily digestible foodstuffs.

HOW KWAK MAY BE USED.

The uses of kwak are many. It may be eaten raw, *i.e.*, without any further cooking—and this fact makes it invalu-

able, on long bush trips, for hunters, balata bleeders and others who earn their living in the hinterland. It is a capital adjunct to fish of any kind—dried, barbacued, salt or fresh—and to soups.

Porridge can be made of it in a few minutes, by pouring hot milk on it and adding a little sugar or other condiment to taste. "Cookies" and other cakes can be made of kwak, as well as puddings. Finally, experiments are now being made on the value of kwak as a food for cattle and fowls, and the results, during the short time the trials have been carried on, appear quite promising. Fowls, especially, acquire a great liking for kwak, which naturally need not be so carefully prepared when intended for animal food as when designed for human consumption.

Action of Bacteria on *Stegomyia* Eggs.

In a paper read before the Royal Microscopical Society on December 20, 1916, Mr. A. Bacot recorded some remarkable facts concerning the relation between the hatching and development of the larva of the yellow-fever mosquito (*Stegomyia fasciata*) and the presence of bacteria and yeasts In sterile water or in "killed" cultures of various bacteria and yeasts, the author found that the proportion of mosquito eggs unhatched within a normal period was much larger than when a living culture or stagnant water teeming with organic life was employed. Of the "refractory" eggs first mentioned a large proportion hatched out at once on the addition of a small quantity of brewer's yeast, or other living micro-organisms, to the prevoiusly sterile fluid.

—"Nature," January 11, 1917.

Meeting of the Board of Agriculture.

A meeting of the Board of Agriculture was held at the offices of the Board, on Thursday, February 1, the Hon. C. Clementi, (Officer administering the Government) presiding.

THE PLANT STALLS.

Referring to the sale of plants at the Board's stalls which had been the subject of discussion at the last meeting, the Chairman (Professor J. B. Harrison) stated that the sales were still falling off, and the Board had ordered the closing down of the Georgetown Market stall. That at New Amsterdam was doing no better—the sales did not cover the cost of the stall, and it too had been closed. The Pomeroon stall did not cost them anything for upkeep, so it was being continued. The stall at Morawhanna had been abolished since 31st July, 1916. As soon as the War was over and the people would again buy economic permanent plants, the stalls would be re-opened.

POSTER FOR RICE-PLANTERS.

The Chairman announced that the Board had issued a special poster on the subject of rice-planting, at a cost of $12, and of this they had distributed 310 to rice-farmers and 69 to police stations and other places. He thought that later they might extend the system with advantage and deal with their products.

THE STUDENT ASSISTANTS' SCHEME.

A scheme, adopted by the Combined Court, for the training of student assistants at the Department of Science and Agriculture was laid on the table. An annual synopsis of mill data from the Java Sugar Experiment Station was also tabled—the Chairman remarking on the fact that in Java everyone was made acquainted with what was being done, while in British Guiana sugar manufacturers appeared to like to keep such things to themselves.

Mr. Shields thought that that was because the local factories were not so up-to-date as those in Java.

SUBSIDISED AGRICULTURAL INSTRUCTORS.

The Chairman suggested that it might be possible to adopt some scheme for subsidised men to act as agricultural instructors, as was done in Jamaica with fair success; and on the proposal of the President a small Committee was appointed to consider the matter.

RESOLUTIONS OF SYMPATHY.

Sympathetic references were made to the deaths of Mr. Cecil Morris and Mr. Frank Fowler; and the Board resolved to record its regret and to offer its deep sympathy to the widows in each case.

THE VICTORIA-BELFIELD SHOW.

Commenting on the Report of the Agricultural Show of the Victoria-Belfield Society, the Chairman said that although the exhibits were not numerous they were of excellent quality. The scarcity may have been due to the Show being held at the end of the year instead of in July or August. The membership of the Society was not large enough to qualify for a grant from the Board.

His Excellency said he visited the Show, but was disappointed to see that although there was a large crowd, chiefly of women, outside the gates, which took a great interest in the band and the dancing. Little serious interest was taken by peasant proprietors in the Show. He agreed that such Shows should be held in July or August.

AFFAIRS IN THE CANALS POLDER.

The Chairman announced a favourable report from the judges in the Farmers' Competition on the lower East Coast. He stated that the drainage competition for small proprietors in the Canals Polder had had to be postponed on account of heavy rain and consequent floods.

His Excellency stated that very great improvements had already been carried out in the Polder area, but the scheme would not be a success until canal locks were provided, which would be expensive. He thought that the Polder

Authority should prepare an estimate for these, and that the Colony might possibly participate in the scheme.

DEMONSTRATION PLOTS.

Professor Harrison, alluding to the demonstration plots in Berbice, remarked that the farmer to whom the plots belonged had been very keen on getting assistance from the Board, but later the majority of them neglected their cultiations. The cost of each plot was about $40 or $50 per annum, and was taken from the Contingency vote. The plots were at present confined to Berbice. He suggested that Mr. Beckett might be charged with the task of selecting the sites for new ones in that county.

This was agreed to.

PEDIGREE BOARS.

The Chairman alluded to the difficulty experienced in finding suitable accommodation for the pedigree boars which were to be on service in country districts. The local associations had no funds available for the erection of suitable pens. It was decided to refer the matter to Mr Shankland who would consult with the Village Councils.

GOOD SALES OF RUBBER.

In connection with the sale of rubber prepared by his Department, Professor Harrison reported that in 1916 they had obtained the highest market price, on the day of the sale. The yield from the trees had been very good. One lot of rubber—about 1,000 lbs.—fetched 3s. 4½d. per lb., and another—a little over 500 lbs.—realised 2s. 6¾d. per lb. A third consignment—about 1,200 lbs.—was now in London awaiting sale.

LEAF DISEASE OF HEVEA BRASILIENSIS.

With regard to the leaf disease of *Hevea*, Mr. Bancroft was now making a special study of it. The disease had affected practically all parts of the colony with the exception of the Pomeroon district. He laid on the table Mr.

Bancroft's report on his recent visit to Surinam in connection with the leaf disease.

Mr. Beckett pointed out that Mr. Bancroft was quite right when he stated that the disease could be successfully combated by spraying the trees at the right time. The main difficulty was in obtaining the proper apparatus.

LIVE STOCK.

The Chairman reported that the Live Stock Sale had resulted in a net amount of nearly $1,900.

The Chairman, in suggesting that the live stock farm might now be enlarged, mentioned that no stallion had been imported since 1904. A Committee, with Mr. Cannon as Chairman, was appointed to consider the matter. The question of importing donkey mares to improve the breed in the Colony was also referred to this Committee.

The Board then adjourned *sine die.*

Wood Ash as Manure.

As wood matures the proportion of potash and of phosphoric acid decreases, while that of lime increases, so that the ash of old wood is not so valuable as that from young branches and leaves, in which phosphoric acid and especially potash largely occur; and whenever possible such material should be chosen in preference to old wood for the preparation of ashes for agricultural purposes.

The ash from tobacco waste is a most valuable soure of potash and one which should be developed.

—"The Tropical Agriculturist," October, 1916.

Hints, Scientific and Practical.

Agricultural Education in India.

AGRICULTURE, as such, is no longer taught in the primary and secondary schools, for it is *now agreed that rural education must be* general, and that it is necessary to develop the pupils' powers of observation; this, however, does not prevent the use of text-books dealing with familiar objects connected with agriculture.

In the secondary schools, great importance is attached to knowledge of English, to nature study, and to practical instruction in the rudiments of chemistry and botany, in order to enable the pupils to profit by the courses at the Agricultural Colleges. The Government of India no longer insists upon a "standard" curriculum in the latter, but leaves the Province free to frame its own scheme of agricultural education *with reference to the stage* of general educational development and agricultural research that may have been reached. Lately, a native agricultural school has been started in Bombay. This school takes boys from 14 to 16. The course is thoroughly practical and lasts 2 years, while general education is continued, together with special instruction in agriculture.

—"The Tropical Agiculturist, December, 1916.

Gutta-Percha.

THE product known as gutta-percha first attracted attention in Europe about the year 1843, when samples were sent to England from Singapore.

It was first described as "wood" and was known as "mazer wood." It is difficult now to understand how such a mistake can have occurred, but it is to be presumed that those who were responsible for it could have known only that it was the product of a tree, but could have had no knowledge of the method of production. It is remarkable that such authorities as Sir William Hooker and the Tradescants should have fallen into this error. The tree from which these samples were obtained was first described by Hooker, and was placed by him in the genus *Isonandra* of the natural order *Sapotaceae*. Further investigations,

however, led to its being assigned to the genus *Dichopsis* by Bentham and to that of *Palaquium* by Burck, and it is by the latter name that the majority of trees which produce the most commercially valuable gutta-percha are now known. The genus has been divided into many species.

*Gutta-percha is not infrequently confused with rubber. In appearance the two products are much alike, when in the form of latex, and in a general way they are obtained from the tree in the same manner, but there the similarity ends. The latex of gutta coagulates and dries more quickly than that of rubber, on exposure to the air. The time required for coagulation varies in the different species: it is rapid in the case of *P. oblongifolium,* small quantities of which coagulate and harden after contact with the air for a few minutes The most obvious difference between gutta and rubber is that the former is only slightly elastic; it does not, as does rubber, derive its chief value from its elasticity. One of its most valuable properties is that it becomes soft on being subjected to moderate heat without losing its other physical characteristics. At a temperature of 140° Fahrenheit it becomes plastic, having about the same consistence as glaziers' putty, but having none of the stickiness of that material On cooling it hardens and retains any shape given to it while in the plastic state.

As regards the uses to which gutta-percha is put, by far the most important is the insulation of submarine and underground electric cables. Many other substances have been tried, but nothing has yet been dsicovered which gives such satisfactory results, and hitherto it has been practically the only material used in the construction of all the submarine cables that have ever been laid. It will be seen from this statement how very important it is that steps should be taken to ensure the supplies of the future. The quantity required for the maintenance of cables is not large, but tough as gutta percha is, it is not indestructible, and in course of time the insulating covers have to be renewed. In spite of the introduction of wireless telegraphy new cables are constantly

being laid, and those who are in the best position to judge do not anticipate that wireless will ever entirely supersede cable telegraphy, owing to the difficulty of obtaining secrecy

by the former method. Within the British Empire the responsibility of maintaining supplies falls entirely upon the Malay States and North Borneo. About three-quarters of the gutta-percha-producing area of the world is under Dutch control, the remaining quarter being British.

Gutta is also largely used in the manufacture of surgical appliances, funnels, bottles, and other articles which are employed in frequent contact with acids, its resistance to acids and the ease with which it can be completely sterilized, being among its valuable properties.

It is suitable for many other purposes, but it use has always been limited by the uncertainty of the supply. A form in which it is familiar to the general public is the outer cover of golf balls.

—"The Agricultural Bulletin of the Federated Malay States": November, 1916.

A Theory of Rainfall.

It has been proved that there is an intimate connection between the plant-life of an area and the precipitation and retentive power of that area. First, as regards the precipitation on an area, it is found that rainclouds are either attracted or repelled by the condition of the ground-surface. This is chiefly due to the amount of heat radiated by the ground. Clouds, or in their initial condition, rather air currents laden with moisture, strike an area. Whether or not the moisture in the air is deposited depends on the heat of the ground struck. If this is warm—at any rate, warmer than the air-current—the result is the expansion of the air forming the current, and in the expanded condition it can hold more vapour and therefore will deposit none of what it originally had. But, on the other hand, if the surface struck is cooler than the air-current, the result is the reverse. The volume of air is reduced and in proportion its water carrying capacity is diminished. The vapour in the air-

current is condensed and it primarily assumes the form of a visible cloud; it is then precipitated as mists and gentle rains The problem at this stage then is to get the ground surface into the cool condition which induces gentle precipitation

There are only two means by which this can be done: firstly by having the surface so shaded by herbage as to be always cooler than the surrounding air, and secondly by having it, if bare, in such a condition that it is able to absorb and conserve moisture when precipitated and to evaporate it slowly but continuously when no precipitation is taking place. Ploughed land is an example of this condition.

The first of these means—the ground surface so shaded as to be constantly cooler than the air coming in contact with it—is the means devised by Nature for inducing and retaining regular precipitation.

—"The Tropical Agriculturist," October, 1916.

The District Gardens.

Under the name of "District Gardens" most of the Model Gardens founded in 1908, and suspended by the action of a resolution of the Combined Court in March, 1915, have now been reconstituted. Below will be found the details of the attendances at these gardens from January, 1911 to the end of March, 1917. It will probably be a considerable time before the numbers approach those recorded for the Model Gardens, as the increasing interest and confidence of parents, teachers and children received a rude shock—and these things are plants of slow growth.

Year.	Bourda.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	Suddie, Essequebo.	Dem Amstel.	Houston, E. Bank.	Wakenaam.	Total Attendances.
1911 ...	5,129	3,600	2,869	1,509	2,230	2,561	2,444	20,342
1912 ...	5,514	4,395	3,302	2,100	2,544	2,156	1,718	21,729
1913 ...	5,156	4,535	2,519	3,399	2,568	1,836	1,319	21,332
1914 ...	4,243	3,869	2,443	3,025	1,791	1,653	1,533	18,557
1915 ...	1,123	1,006	769	59	503	339	401	4,200
1916 ...	4,705	1,161	1,510	225	623	2,251	1,297	12,026
1917.								
1st Quarter	1,517	762	463	880	326	712	470	5,130
2nd Quarter	1,534	725	238	947	273	917	356	4,990

Exports of Agricultural and Forest Products.

Below will be found a list of the Agricultural and Forest Products of the Colony exported during the first 6 months of this year (1917). The corresponding figures for the two previous years, and the averages for the four years previous to that are added for convenience of comparison.

Product.	*Average 1911-14.*	*1915.*	*1916.*	*1917.*
Sugar, tons ...	26,686	42,440	37,494	52,696
Rum, gallons ...	1,236,240	2,031,023	2,496,763	1,617,537
Molasses, casks ...	644	...	...	863
Cattle-food, tons ...	2,652	979	522	1,023
Cacao, cwts. ...	121	284	29	...
Citrate of Lime, cwts.	5.5	70	304	84
Lime Juice, ordinary gals.	*	*	*	3,178
Lime Juice, conc., gals.	*	*	3,057	2,071
Essential Oil of Limes, gals. ...		*	198	166
Coconuts, thousands	726	1,064	893	1,150
Coconut Oil, gals....	*	*	14,156	11,913
Copra, cwts. ...	775	842	1,206	451
Coffee, cwts. ...	1,035	679	2,342	1,863
Kola-nuts, cwts. ...	...	2	...	...
Rice, tons ...	2,705	5,653	8,590	9,602
Ricemeal, tons ...	722	205	85	49
Cattle, head ...	461	307	341	487
Hides, No. ...	2,340	864	2,551	1,153
Pigs, No. ...	698	540	612	455
Sheep, head ...	22	4	22	9
Balata, cwts. ...	1,854	7,568	4,194	4,378
Charcoal, bags ...	43,224	28,236	27,431	22,394
Firewood, Wallaba, etc., tons ...	5,287	4,442	6,099	5,002
Gums, lbs. ...	1,794	...	883	112
Lumber, feet ...	208,253	31,619	211,015	55,205
Railway sleepers, No.	2,500	556	1,825	16,413
Rubber, cwts ...	6	17	55	64
Shingles, thousands	1,155	1,070	1,911	1,118
Timber, cub. ft. ...	161,591	55,807	74,231	22,489

* No records available.

No. 1326
26 MAY 1936